Nature Magazine

VOLUME 35 NUMBER 5

MAY 1942
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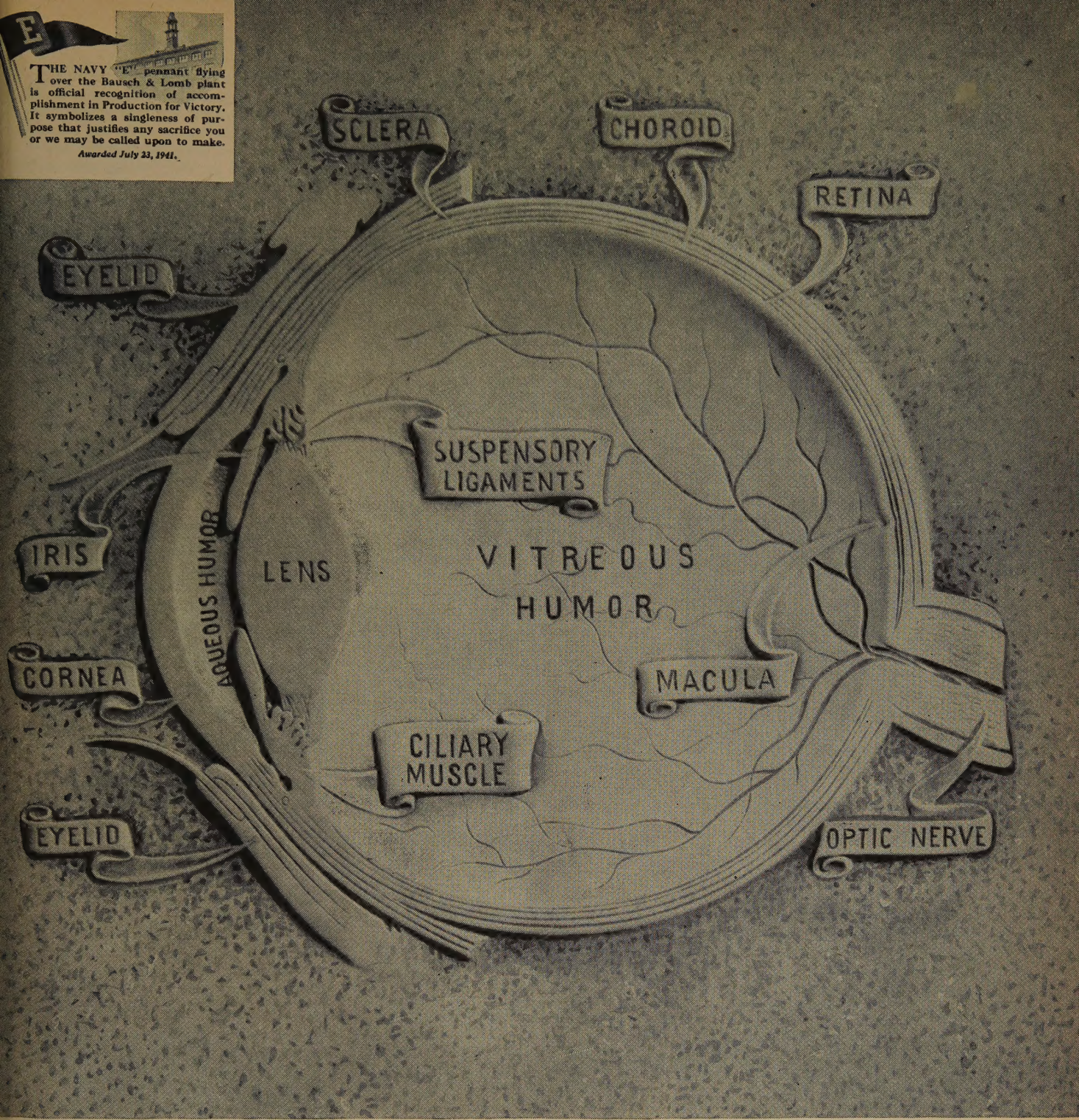

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Camera Trails

BY NORRIS W. HARKNESS

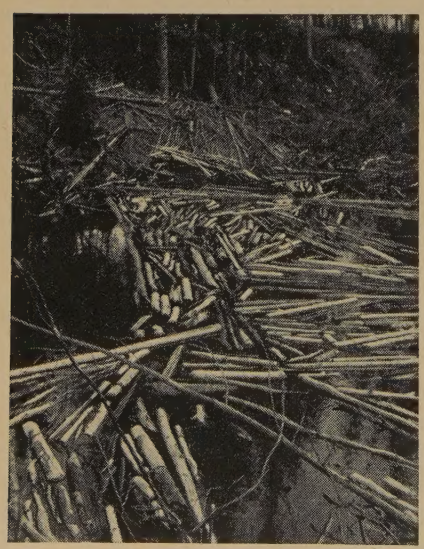
Meaning in Pictures

In April we talked about farm animal photography from the standpoint of making records of the animals themselves rather than as using them for pictorial subjects. For the latter purpose they are second only to babies in popular appeal. Young animals, of course, share the sentiment that makes baby pictures so successful, but their parents are excellent subject material as well.

These pictures, however, need to be something more than just good snaps of a horse or a cow from a distance, and they need to

1. The beaver lodge, living quarters above water, entrances deep below the probable ice line. The lodge was about twenty feet in diameter.

be much more than mere records of the appearance of the animal from a distance. A recent British publication has said that a pictorial picture must be more than a photograph of something that is already beautiful, and we can add that its being either beautiful or interesting is not enough. Something of the photographer must be included in the shot, and that something, which we often call imagination, is perhaps best expressed as the



2. Another lodge with a floating pantry. Some trees had been brought a quarter of a mile, as shown by the clear paths running from stumps to water.

3. The beaver off on a foraging expedition. He may be seeking small branches that he takes back to the water for food. His gathering of material for the lodge is at night.

story-telling part of the picture.

A cow's head sticking through the fence may be just a cow's head, and as such it may be a splendid photograph, but if it carries the idea of the greener grass on the other side of that fence, it will tell an appealing story that will add to the effect tremendously. In the same way, horses pulling the plow should express the photographer's admiration of their strength or his feeling for their usefulness in adding to the country's food supply, or some other real feeling that the scene arouses in his mind when he makes the exposure. The world's best photograph of a dog may be fine for a dog show advertisement, but it cannot have half the interest of the technically poorer shot that shows his absolute devotion to his young master.

So it behooves the photographer who is planning to use farm animals for picture subjects to watch for scenes that arouse some emotion in him. Then the problem becomes one of catching that feeling in his picture. When he has succeeded in that aim, the emotion will be felt by those who see his work, and they will enjoy his picture and its message—a far more effective result than just admiration for his photographic ability.

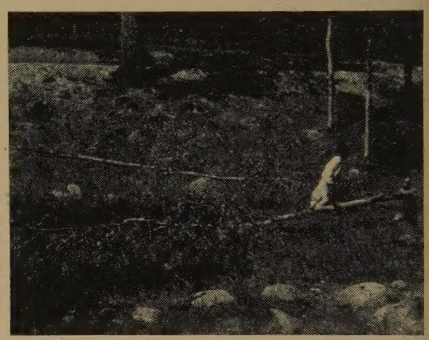
The way to go about achieving this aim is to concentrate on the subject with the aim in mind. There are the horses plowing the long field. The sky has clouds and the sun is not too high in the sky. There is no hurry for the team will go back and forth across the field time after time giving you plenty of time to select the exact spot they should occupy in the picture and just what needs to be behind them.

The next step is to watch the action and determine just what is most exciting in the whole scene. Is it the straining of the neck and foreleg muscles, or the effect of the team at a greater distance, or should the contrast between the growing grass and the freshly-turned loam be made more important? Go over each possible plan in your mind. Try to catch each one through the viewing arrangement of your camera and see whether a lower or higher viewpoint may be best.

Then chart in your mind the several possible pictures. There will be one with the plow moving toward you while the camera is almost on the turned sod and the whole foreground is the fresh furrows. Probably in that one it will be best to let the team get quite close before you make the exposure—so close that their heads and shoulders are rather out of proportion to the man behind them. A small stop and a fairly long exposure through your deepest filter will undoubtedly be preferable.

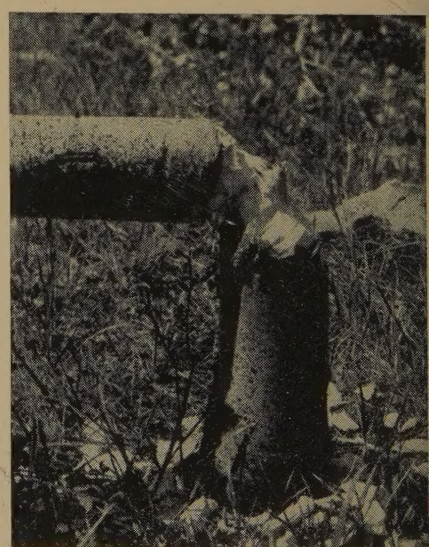
Another possibility might be the straining of the plowman as he struggles with a particularly bad spot in the field and the low angle will probably be good for this one too. Still another is a long shot down the newest furrow toward the disappearing plow as it approaches the end of the field. Keep the camera low and shoot before the trees beyond extend above the moving subject. But each field and almost every moment in the entire plowing will make another picture for the imaginative photographer. He has only to look for the emotion that the moment arouses and then try to hold it in the exposure and the printing.

Some of these picture possibilities are fairly long shots, but most pictures suffer from the inclusion of too much in the picture area and closer viewpoints are often better. The horse's head as he drinks from the trough, or the cow's as she grazes, may well be better than the whole animal, and it is almost certain that either will surpass the shot made while the animal is acutely conscious of the



4. Two trees that were cut down during a night's work by the beavers. The stumps are left about a foot high. The nearer tree is the one shown below.

photographer and stands quietly looking at the lens. Keep the feeling of accomplishment, of something happening in the shots, and that means that something must be happening when the exposure is made. It need not be anything extraordinary or exciting in itself, but it must give the feeling that it is an action shot; that the photographer selected the one perfect instant for the exposure. If it does hold that feeling, those who see the



5. A work of the beaver's night. This five-inch tree was about three hundred feet from the water. It was taken to the lodge probably the next night.

finished picture will feel the life and action and emotion—and they will enjoy the picture. If it is a static representation of another animal doing nothing, it will make them feel that the shot is worth just that and no more.

So watch for the angles and distances and viewpoints that will catch a sense of living motion in the pictures. Others will like your work better and so will you.

Series Pictures

From time to time I have suggested making pictures in a series to tell a more complete story than can be expressed in one, single shot. Gardens, trees, landscapes, and almost all outdoor scenes lend themselves to series that start in the morning and show the appearance all day, or that begin in the spring and carry the observer through the year. The more active Nature pictures are especially attractive when treated with this technique.

Last June in Jasper National Park, Alberta, Canada, I had the opportunity to make a number of shots of beavers and their lodges. There was little time to give to them, but a real interest in beavers led me to concentrate on them rather than on larger and more active animals. In parts of two days these shots were made. Many of them were done hurriedly and in no case was there enough time to get everything set as I would have liked.

All the shots were made with Plus X film in a Super Ikonta B camera. No filter was used, but a lenshood was on the lens for every exposure. The exposures ran from 1/100th second at f/16 to 1/10th at f/4 for one made after sundown. All were developed in Defender 777 and printed on Kodabromide developed in D-72.

Note that the story is told quite fully in the short captions and that the few words plus the illustrations are practically all that is needed. Of course, a more detailed account might well be given, but these shots may suggest how you can use your coming vacation to good advantage.

The Problem Corner

J.C.S. of Northwood, North Dakota, asks a question that bothers most photographers at some point in their career: "Is it not advisable always to use fast film?"

ANS.—There are two distinct points of view on this film speed question and both sides have good arguments in their favor. Those who prefer the fastest emulsions point out the fact that smaller apertures can be used to insure all-over sharpness with fast enough shutter speeds to keep the camera from wiggling, and they also refer to the fact that fairly high shutter speeds can be used even when a red or other heavy filter is on the lens. They also mention the admitted advantage of using the same film all the time and advocate the fastest emulsions for their easier use in very bad light or at night.

Users of the medium speed films prefer them for their finer grain—which enables the photographer to make bigger prints from the negatives—and point out that the occasions for the greatest speed are so infrequent that no trouble will result from the use of special films for them. They admit the fact that deep filters can be used with shorter exposure times than their medium fast emulsions, but find that practically all such exposures can be made perfectly well with films whose Weston ratings are either 24 or 50. They also show the advantages of slower films when only shallow depth of field is wanted, and ask how the fastest emulsions can be used when the shot needs to be made at a wide aperture and the shutter has no suitable speed.

On the whole, the amateur will do well to follow the lead of most professionals who prefer the medium speed film for nearly all work. They find the quality of the prints is better, the grain is finer, and the standardization on the one type of emulsion helps to fewer errors. Probably the best practice is to use something like Panatomic X, Plus X, Verichrome or their equivalents for all regular work and have a few rolls of the faster emulsions available for the worst light conditions. Either plan can be followed with excellent results, but the recommendation holds for most amateurs.

F.L.Y. of Pendleton, Oregon, asks: "Is there danger of having my prints get moldy if I dry them in a blotter roll?"

ANS.—Not at all, provided the roll gets really dry when it is used. Mold forms only in the presence of dampness and an occasional thorough drying will kill the mold formations. If the roll gets dry enough for the prints to be dry when they are removed, there is no danger of mold in either roll or prints.

G.T., Richmond, Virginia, asks: "What are my most likely difficulties on an early spring trip to the interior of Mexico?"

ANS.—Very few as the climate of the higher parts of Mexico is not unlike that in the United States except for somewhat higher temperatures. Extraordinary packing is necessary only in the humidity of the southern coastal areas. You will find the brilliance of the direct sunlight misleading, and your exposures will need to be only about half a stop to one full stop less than for similar scenes at home. The contrast between highlights and shadows is greater than in Virginia because of the clearer air—especially at higher altitudes—and the absence of the moisture that reflects sunlight into the shadows, so full exposures are better. Otherwise your problems are familiar.

F.D.L. of Yonkers, New York, asks: "I wish to increase the contrast on my negatives. Is it better to raise the temperature, lengthen the time, or agitate the tank more?"

ANS.—The answer depends upon your present practice and on the developer you are using. If you are now working at the optimum or recommended temperature of your formula, do not change that factor. If you are working at a lower temperature, raise it to the point recommended by its maker. If your agitation is a gentle but thorough motion as often as every thirty seconds, leave that point alone, but if you agitate the tank less often try doing it more frequently. With those two elements satisfactory, lengthen the developing time. Your negatives are the result of all three factors and each is very nearly as important as the others.

This and That

Too many photographers seem afraid to keep their cameras at work because of the war conditions. They leave the equipment at home because they may be stopped, or may get into trouble by innocently trying for a picture of some forbidden subject. This attitude is a mistake and is contrary to the statement by President Roosevelt suggesting the con-

(Continued on page 229)

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CAMERA TRAILS

(Continued from page 227)

tinuance of our usual recreational activities. Keep your camera at work and keep on making pictures—the best pictures you can make. Avoid wasting material and think a bit before you make each exposure, but keep up your photography. Shoot all the subjects you know are all right, and ask for permission in case of doubt. Only a few subjects are "out of bounds", and the authorities are as anxious for us to continue as we are.

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2. Be as sure of your exposures as possible.
3. Develop negatives according to standard practice in a known developer. Save your experimenting for experimental films.
4. Make test strips before using whole sheets of paper for either contact printing or enlarging and develop, fix and wash prints carefully.
5. Work slowly and try to visualize the final result as you go along.

Camera Trails is given space in Nature Magazine for you. To make Camera Trails of most value to you its editor needs your suggestions and criticisms. Also he will be glad to help you solve your photographic problems. Mail your communications to Norris W. Harkness, NATURE MAGAZINE, 1214 Sixteenth Street, N. W., Washington, D. C.

More About Water

This is the title of the January, 1942, issue of the Cornell Rural School Leaflet. It is complementary to earlier leaflets that have considered water in relation to soil, with respect to recreation and as essential to wildlife. In this most recent leaflet a variety of the important facts about water are considered, ranging from safety on the water to water power. Dr. E. Laurence Palmer has made this a most interesting issue, stimulating to further investigation and exploration, as well as fascinating reading.

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Nature in Print

By HOWARD ZAHNISER

THERE could hardly be at present a more welcome book to the readers of this magazine than Gove Hambidge's *The Prime of Life,* a contemplative and engaging essay-chronicle of a day in his life—a May day, a Saturday, and, despite its reasonable questionings and ponderings, a day of satisfaction for a man who has lived half a century to find himself doing a worthwhile work in an atmosphere of companionship. Mr. Hambidge, who earlier wrote an excellent handbook called *Time to Live,* and an account of rural living in *Enchanted Acre,* and later discussed life as radiating from the home in *Six Rooms Make a World,* now sketches his prime in terms of the time of day, in nine thoughtful chapters—from "Half Past Four in the Morning", when the birds "greeted the new day with habitual violence," to "Before Midnight," when he was on his way to "sink gladly into the dark pool of sleep," knowing that in the morning there would again be "birds to hear."

"I selected a spring day," says Hambidge in a paragraph that represents the book's appeal better than comment, "simply because that is when there are the most birds and flowers. Life is a very serious affair nowadays, and quite a number of people are beginning to say that this is no time to be thinking about birds and flowers; there will be time for that later when we get the world's problems settled. And this is true in a way. Yet it reminds me of the people who look forward to the freedom they will have when they retire from work in old age, and then when they do retire they die of sheer boredom because they have not learned how to live free of dictates and constraints from outside themselves. It is better to create a free area, and practice making the most of it, in the very midst of the constraints and dictates. The world's fundamental problem, in a symbolic sense, is how to have more birds and fewer bombs, more flowers and less starvation of body and spirit, in the ordinary life of ordinary people; and I doubt whether excluding birds and flowers from our thoughts and concentrating only on the bombs and the starvation is the right way to solve it."

Lived thus with a consciousness of the fundamentals of living, Gove Hambidge's day is, however, not spent in remote contemplation. Being Saturday, the afternoon brings friends to his home for backyard sports, including a game of badminton with Henry A. Wallace. The day's table and living-room conversations are modern and alert. Hambidge's hours at the office are those of an earnest worker in the Civil Service. In brief, *The Prime of Life* is the work of a man who is rare in his sensibilities but in the main is a representative citizen of our own times. The volume holds rich rewards for the reader.

Not the least interesting thing about Gove Hambidge is the work that he does at his government office, and has done for a half dozen years. Throughout each year he devotes his time to the preparation of a book that takes its place in the yearbook series of the Department of Agriculture, assembling the specialists' chapters on various aspects of the major subject of each particular volume, editing these, preparing brief catch-summaries of each, and then writing an over-all discussion as an introduction that will have readability for the layman.

The remarkable thing to one who has read many hours within these volumes is the fact that it takes only a year to produce one of them. The first subject handled, genetics, did in fact require two volumes—*Better Plants and Animals,* Volumes 1 and 2, 1936 and 1937—but each was as large as its successors, *Soils and Men,* 1938; *Food and Life,* 1939; *Farmers in a Changing World,* 1940; and the latest, *Climate and Man,* 1941. Designed "as a set of reference volumes for modern farmers," these yearbooks have value for any reader who is interested in the fundamentals of living, and one can hope that the series will continue for many years. The man who lives alone on that famous island, if permitted one book on each annual visit of a supply ship, might well choose Mr. Hambidge's yearbook. None of the rest of us, I fear, will ever have the time to read one through, but those who are entirely dismayed by the formidable size of these volumes are missing a great deal of good reading and, incidentally, a bargain in books.

Truly timely is the current volume, *Climate and Man,* accompanying a general interest in geography and a curiosity aroused by the war-time secrecy regarding weather reports. If there is anything regarding the relationships of climate to human concerns that is not included in this volume it must be a detail that had to remain in Mr. Hambidge's files. From "The Colonization of Northern Lands" by Vilhjalmur Stefansson, to tables of data for nearly every county in the nation, the subjects treated in this one book are encyclopedic in range and also in thoroughness. Nevertheless, the book, with Mr. Hambidge's aids, can be read with understanding by a layman.

Climate and Man makes apparent the far-reaching influences of weather on the many aspects of our social, economic, and personal lives, yet one who has not read George Stewart's recent best seller, *Storm,* has little idea of how dramatic and vivid an account of these influences can be when related to human activity by the art of the novelist. Described as unique in fiction for its use of a storm as the principal character—named Maria by the personifying junior meteorologist in the weather bureau—the novel is at the same time remarkable for its array of dramatic incidents, often (Continued on page 274)

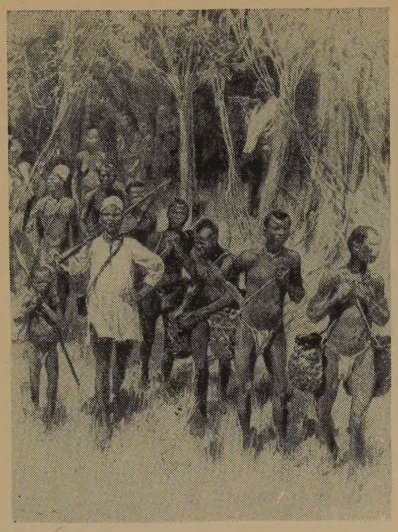
Recent books discussed in this article are:

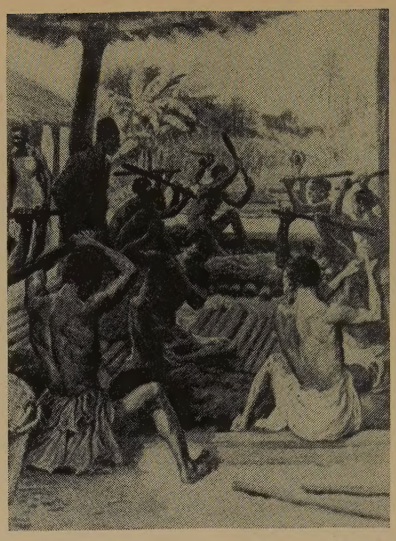
The Prime of Life. By Gove Hambidge. New York: Doubleday, Doran & Company, Inc. 1942. 243 pp. $2.

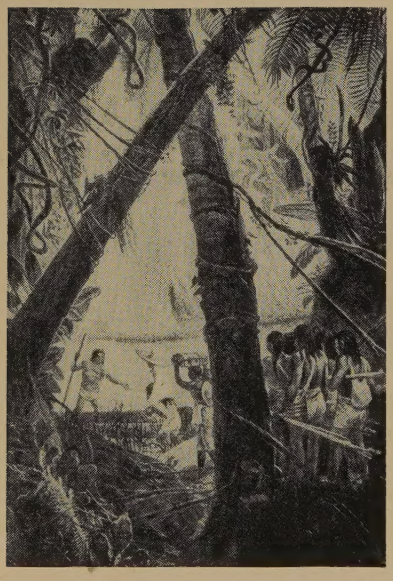
Climate and Man: Yearbook of Agriculture. Edited by Gove Hambidge. Washington, D. C.: Government Printing Office. 1941. 1248 pp., with numerous maps, charts, photographs, end-paper map "The Pattern of World Agriculture" by Erwin Raiscz after D. S. Whittlesey, numerous references to literature cited, tabular climatic summaries, and index. $1.75.

Storm. A novel by George R. Stewart. New York: Random House. 1941. 349 pp., with end-paper drawing by Steinberg. $2.50.

Weather and the Ocean of Air. By William Holmes Wenstrom. Boston: Houghton Mifflin Company. 1942. 484 pp., with 65 text figures, 36 photographs, 8 weather maps, and index. $4.50.

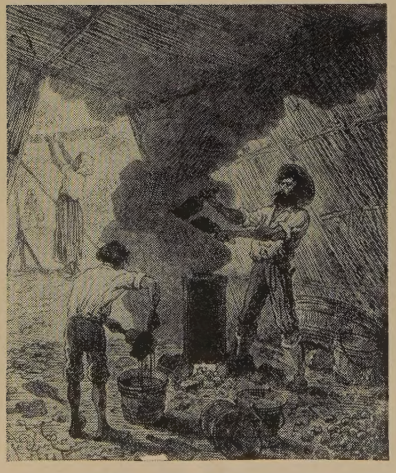






The early history of rubber is filled with romance and adventure; with the primitive uses of one of the greatest of Nature's gifts. On this page are some of the scenes of this early history. Above is a drawing of natives in the Congo region bringing rubber out of the jungle; of the process of thumping the rubber to remove particles of wood and fibre; of natives using the human body as a solidifier of rubber by rubbing latex on arms and chest, and allowing it to dry and harden from the warmth of the body before stripping it off.

At the left is a scene in the Brazilian jungle at the time when the vast rubber resources of this region were first systematically explored and the first rubber company was founded in America, in 1831. At the right a native, circa 1875, turns rubber liquor into raw rubber by pouring the liquid over a stick and turning it slowly over the fire so that a ball of raw rubber is gradually formed.



At the left is a scene of the middle of the 19th Century in the Amazon region. Rubber is being solidified and hung out like clothes on a line after it has been formed over a fire of burning nuts. At the right natives tap rubber trees and collect the latex in a rubber camp on the shore of the Amazon River in Brazil. This woodcut of primitive methods dates from 1865.

PHOTOGRAPHS FROM THE BETTMANN ARCHIVE

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Lack of vision by the people and their leaders have caused—

The Crisis in Rubber

By ALBERT W. ATWOOD

Nature is in this war. Natural resources will decide the course of history now being made. Recognizing this, Nature Magazine asked Albert W. Atwood, distinguished student of and writer on economic subjects, to present the facts about what now may be the most vital war-time resource—rubber. This is the first of several such outstanding editorial features dealing with Nature and economics. The second, Seven Sinews of Strategy—about seven strategic metals—will appear in the next issue.

•

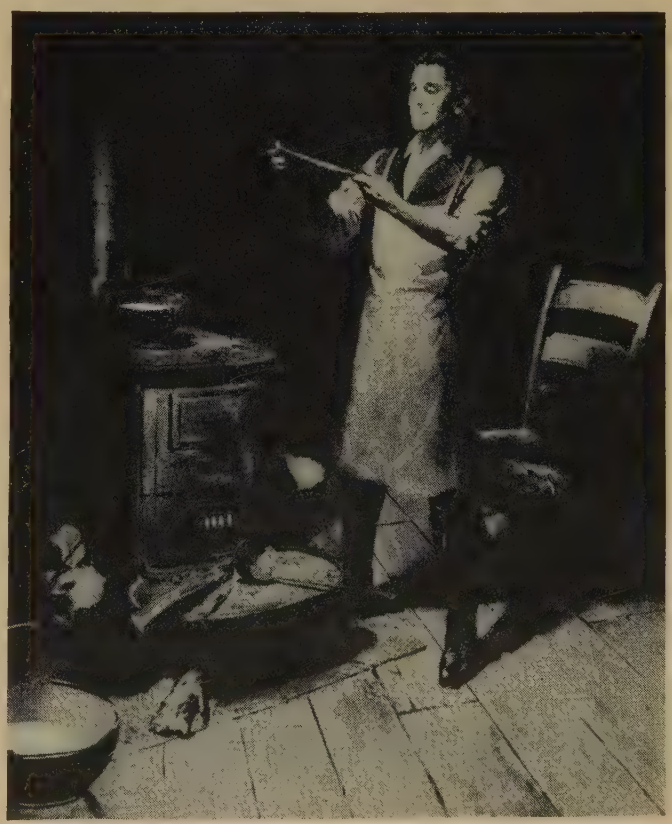
SINCE December seventh the American people have been very slow to wake up to the seriousness of the rubber situation. Yet portentous facts could not have been presented with more stark clarity and utter realism. All there is to it is that Japan has cut off in a few months' time more than ninety-five per cent of all our sources of supply, and that new sources cannot be developed soon enough to prevent a hard and painful adjustment in our whole way of life.

For years we have been told of the danger of dependence upon foreign sources for a few very necessary products, such as rubber, tin, manganese, silk, quinine and tungsten. But the country was so rich, so well endowed with natural resources, and so nearly self sufficient, that warnings fell upon deaf ears.

We continued to buy products where they were cheapest, regardless of their enormous distance from our own defensible areas, and not where the sources were secure against the chance of being cut off in case of war. We did not plan ahead in our use of Nature's gifts; we merely took the easy way.

Probably the how of getting ourselves out of this jam is far more vital at the moment than the how of getting into it. But both questions are intimately related not only to our ability to use natural resources wisely, but to the very existence and survival of the American economy.

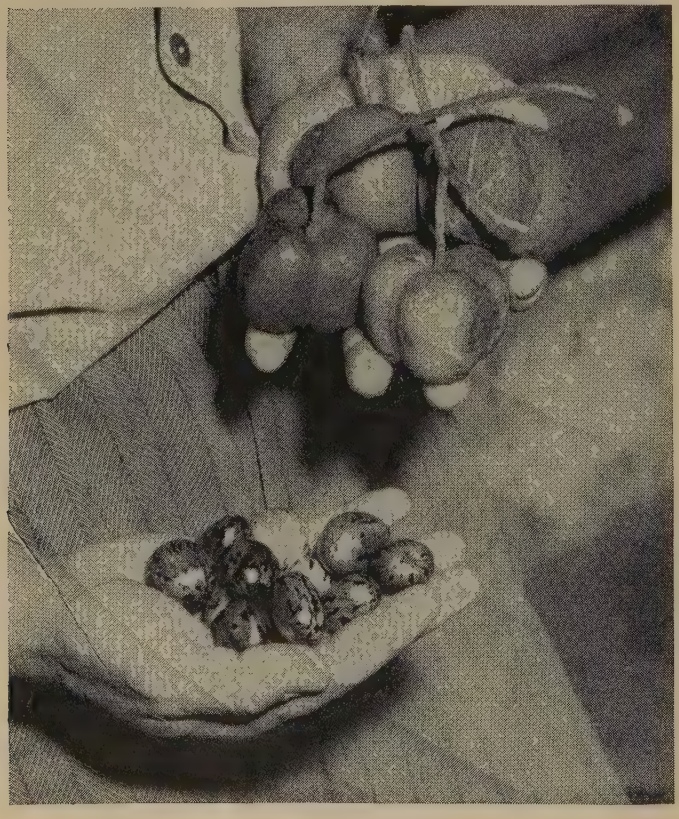
For the whole operation of the American way of life, physically speaking, and especially in war time, depends upon rubber. Without it we could offer only an 1861 defense against a 1942 attack. To put the case bluntly and in unmistakable terms, there is no substitute for rubber for many, if not for all the purposes for which it is used.



A GREAT MOMENT IN RUBBER'S HISTORY
Charles Goodyear discovers the secret of vulcanization. The painting recording this event is owned by the Goodyear Tire and Rubber Company. Photograph from the Bettmann Archive

EXPERIMENT WITH SOURCES OF RUBBER

A tree known as *Castilloa elastica* in the U. S. Introduction Station near Miami. Used experimentally, thousands of its offspring have been sent to grow in Central and South America. It is tapped daily for latex eight months of the year. Below, a scientist at the Station holds seed pods of this rubber tree in one hand and the shelled seeds in the other. These spread the number of trees, the production of which has been increased by selection. Photographs from Press Association, Inc.



Practically it is as indispensable to the fighting forces as ammunition.

The pneumatic tire is, of course, the most extensively used and essential war tool that rubber provides. For how else are vehicles to be shod where speed, flexibility, cushioning and traction are required? True, railroads move on steel, not rubber, and they move vast numbers of troops. But they do not move them to any and every land point in this global war, and apparently the rubber-tired vehicle does. Moreover, the military plane must have rubber tires to take off and land.

A tire, as well as the rest of the wheel, can, of course, be made of wood or steel, but the experience of mankind thus far with wheels, and it is a long experience, does not favor the practice, except where the vehicle runs on rails. About 25 years ago, leather tread tires were used for a time in France and England, but were found to wear out quickly.

The ability of rubber to yield, or change its shape, under load, and quickly return to its original shape after removal of the load, to a degree far exceeding that of any other known substance, puts it in a class absolutely by itself. Until it has a rival in this respect there just cannot be any substitute. Wood, steel, leather and the synthetic resin plastics simply do not have this all-essential quality. Automobiles could move on them but very inefficiently.

It is obvious that tanks and other vehicles in a mechanized army division require an immense amount of rubber; a big army truck uses up to twenty times as much rubber as an ordinary passenger car. In addition to tires the tanks also move on rubber track blocks and have the sharp edges of their interiors cushioned with the same material. Airplane motors have rubber mountings to reduce vibration and improve the bomber's aim. Fuel tanks, and fuel and oil hose, are of rubber to seal bullet punctures.

Rubber cushions the fall of the parachutist, provides safety pads for the lining of bomb racks, and furnishes a moisture and leak proof coating for barrage balloons, blimps and pneumatic boats. Airmen wear rubber-lined electrically heated suits at high altitudes. The Army Air Corps uses 2200 to 2500 separate items. A tank uses a ton of crude rubber, a battleship 75 to 80 tons. An airplane has 400 rubber parts. Pontoon bridges are built on rubberized floats. Gas masks contain rubber, the Signal Corps uses wire sheathed in rubber, and invasion troops use collapsible rubber boats.

Rubber may not be quite the life and death matter in peacetime that it is in war, but no words can exaggerate its importance at any time. Our thirty-odd million automobiles run on tires of this material and they use about 77 per cent of all the rubber imported. But tires are only one of about 280 rubber parts in an automobile; to mention only a few, there are floor mats, running boards, engine mountings, steering wheels, hose, fan belts, gaskets and wind-

shield wipers. Yes, without rubber we could hardly build automobiles.

Just how the modern factory, office building, dwelling, railroad or steamship could operate without rubber is difficult to say. Rubber is a handmaid to practically every modern electrical device, including the telephone and electric light. It is used in wireless apparatus, radio, typewriters, medical goods, industrial, fire and garden hose, orchard spray tubing, milking machines and literally thousands of sundries. One company alone makes 32,642 products containing rubber.

But how did we ever get into a situation where Japan could seize 95 per cent or more of our sources of rubber in a few months' time, and what are we going to do about it? The irony of the present crisis is that the Western Hemisphere, which originally contributed rubber to mankind, is now cut off from new supplies except in the most insignificant quantities.

Europe saw its first rubber when Columbus on his second voyage observed natives bouncing balls made from the juice of trees, and brought some of it back with him. For several centuries, however, it was only a curiosity. In 1770 Jacob Priestley, discoverer of oxygen, noticed that the substance would erase pencil marks and gave it the name rubber. At first it was known as Indian rubber, because it came from the Indians, and then as India rubber.

Very few uses were developed, however, until 1839, when Charles Goodyear discovered that by heating a mixture of rubber and sulphur the resulting combination was no longer soft and tacky in summer and hard and brittle in winter. Incidentally, Goodyear foresaw practically all the modern uses of rubber, except in automobiles and airplanes, which had not been invented.

The Civil War stimulated the use of rubber goods, and so did the vogue of the bicycle from about 1890 on, but it was the automobile, of course, that made it of the first order of importance. As late as 1912 more than half the rubber consumed in this country was manufactured from a milky fluid known as latex, derived from a tall tree, known as *Hevea brasiliensis,* growing wild in tropical America, and especially in the Amazon Valley, a tree which, it is important to note, is the most practical of the hundreds of trees, vines, shrubs and lesser plants from which rubber may be extracted.

In 1876 the British obtained *Hevea* seeds from the Amazon, and, in course of time, translated them to Malaya and the East Indies, forming the foundation of the enormous modern plantation system, now in the hands of the Japanese, and formerly owned chiefly by the British and the Dutch. It is a strange coincidence that while Brazil lost its rubber production supremacy to the Far East about 1912, it in turn became the headquarters for coffee production, which the East had given up for rubber.

The *Hevea* tree is strictly a plant of the deep tropics and conditions suitable for economic production are not found farther away from the Equator than ten or fifteen degrees of latitude. But why did its production leave the Amazon Valley for Malaya and the East Indies, which by way of the Suez Canal, Mediterranean and the Atlantic is a distance of 8800 miles from the chief consuming center, the United States, or via the Pacific Ocean to Los Angeles 11,700 miles, or by way of the Panama Canal 13,300?

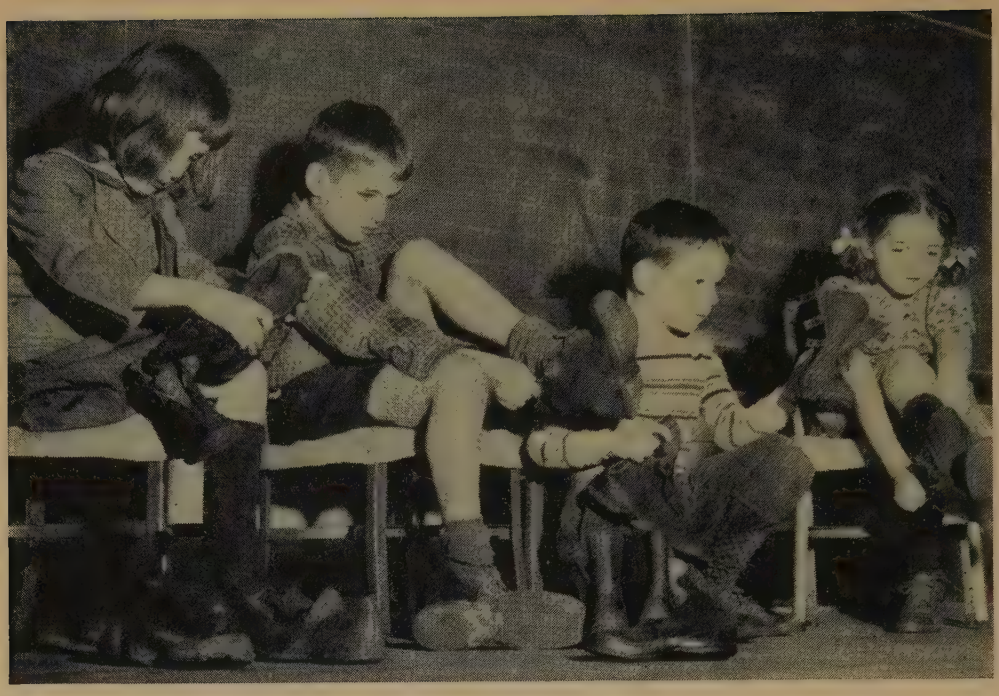
In the vast thick Amazon jungle there is usually only about one wild rubber tree to the acre. In the Far Eastern plantations they stand rank upon rank, closely spaced for convenience in tapping and gathering the latex. Moreover, in the East the trees have been greatly improved by British and Dutch plant breeders and some of them now yield up to five times the amount of latex given by unselected jungle trees. The primitive rubber industry of the Amazon jungle did not

CEYLON'S NUMBER TWO RUBBER TREE

It was planted in 1876 having come from South America and has a noble production record over a period of many years. Photograph from Pix

TAPPING A CEYLON RUBBER TREE

The British Crown Colony in the Indian Ocean is an important but now threatened source of rubber. Below, rubber plantation workers carry containers for the rubber juice on their heads from the trees to the depot. Pix photographs



CONSERVATION OF RUBBER MUST BE ACHIEVED BY ALL POSSIBLE MEANS

These Wayne, Pa., youngsters try on rubbers and overshoes at an exchange set up by the schools. They exchange outgrown footwear and raincoats, and anyone with children knows how fast boys and girls can grow out of shoes and clothes. Here is a suggestion for other communities to copy. Wide World photograph

employ scientists and engage upon long range research; it thus proved utterly inadequate to meet the enormous demands of the automobile as compared with the scientific and regimented plantation industry of the Far East.

But if an actual calamity in the next few years is to be prevented, where are we to get rubber? Naturally the first step is to use as economically as possible the stocks already on hand. By far the largest of these stocks is the material, some 1,200,000 tons of it, already on the tires of the country's automobiles.

A certain minimum of passenger transportation *must* be kept up, and this great stock of rubber can be made to wear much longer by a number of practices, such as less driving, slower driving, avoidance of sudden stops and starts, avoidance of pinching curbstones, and proper inspection and maintenance of tires.

In addition there are the government reserve stocks—the so-called stock pile. The Rubber Reserve Company was formed in July, 1940, one half of its capital stock being subscribed by the Reconstruction Finance Corporation and the other half by the rubber manufacturing companies. Loans were made from the RFC to finance purchases. The company is understood to have made purchases of 673,000 tons, or about a year's supply in normal times.

This stock pile will have to be conserved, of course, by allocating or rationing the rubber for the most essential uses only. Barring unexpected war victories or miracles, millions of car owners will not be able to buy tires for several years to come. In addition other economies will have to be practiced.

Leather, plastics and wood can replace rubber in a number of directions. Moreover, many rubber products can be reduced in size. For years the manufacturing companies have pushed rubber in every possible way and induced its use where other less strategic materials might have served. The American people wanted the biggest, most comfortable and best of everything, and often rubber has catered to this prevailing psychology. Instead of putting all the rubber possible into finished articles the course now will be to put in as little as possible.

But aside from economy, what are the sources of rubber now available to the country? An increase in the production of reclaimed or regenerated rubber offers the maximum possibility of early aid in

CHECK UP ON YOUR OLD AND USELESS RUBBER

Scrap rubber is vitally needed, and cellar and attic may yield old material that can be salvaged and help to relieve pressure on raw stocks. Wide World photograph

THESE RUBBER PLANTATION HOUSES AND TREES ARE NOW IN JAPANESE HANDS

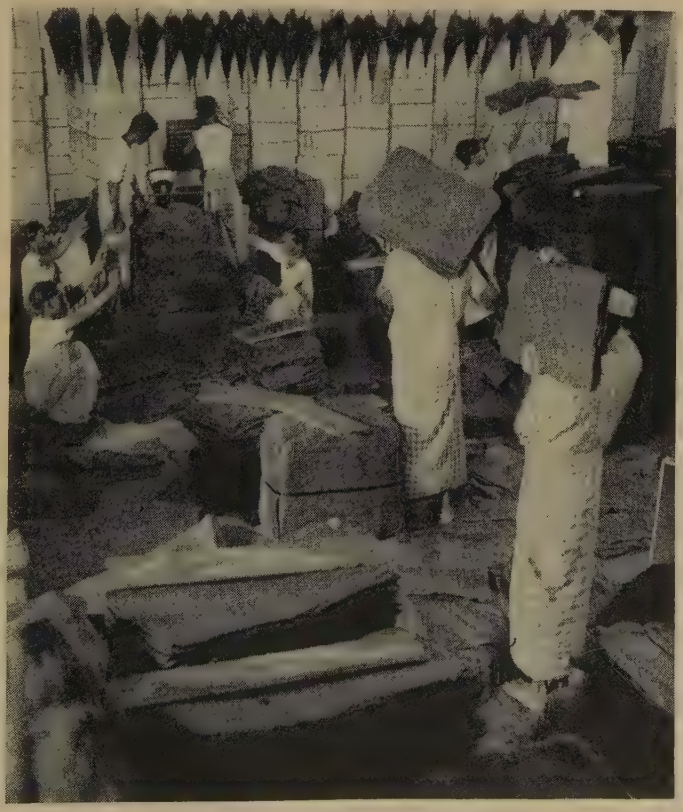
Looking across a river on the east coast of Sumatra near Medan, with rubber trees in the background. Conditions did not, in all probability, permit the scorched earth policy to raze these trees. Photograph from Black Star

the present emergency, because the industry already has a capacity of 350,000 tons a year, and can be brought up to 400,000 or 500,000 tons in a year or less.

As the name implies, reclaimed rubber is made from discarded products or scrap, largely from tires. Although the reclaiming plants already have a high total capacity and despite the fact that there is nothing new or novel in the idea, there are obvious drawbacks to the reclaimed article. For most uses the quality is not as good as that of crude rubber. A tire of reclaim lasts only half as long as one made from new rubber.

There are a few uses for which reclaim rubber is well fitted, but for most purposes it must be mixed with crude, and it is the shortage of crude, of course, which has brought about the pinch. But there is another serious drawback. To reclaim rubber is in a sense to live off the fat of our huge tire production of former years.

Rubber cannot be reclaimed indefinitely like copper; five times is about the limit and the quality deteriorates each time. Moreover, as fewer tires are manufactured there will be less scrap to gather; the sources of material for reclaiming will gradually dwindle. On the other hand scrap can be collected in this country on a far greater and more systematic scale than has ever been done in the past. No time should be lost in this job.



SORTING PRESSED CRUDE RUBBER FOR SHIPMENT

This is in a Ceylonese warehouse. Here the crude rubber is weighed and examined. Note the workers' umbrellas hanging on the crates. Pix photograph

Due to Germany's use of synthetics, and because of unfortunately over-optimistic statements made by certain high officials a number of months ago, the average citizen has the mistaken idea that the solution of the whole problem lies in the manufacture of synthetics. The difference is that Germany had no large civilian use to begin with, and did have a well established synthetic industry.

For many years chemists throughout the world have made innumerable experiments to discover a synthetic substitute for rubber that could be produced on a commercial scale at a price to compete with the natural commodity. Almost every known substance has been used in

A RUBBER PLANTATION IN SUMATRA, ITS OUTPUT NOW LOST TO US

In the foreground are young trees and in the background large and producing trees. Because rubber trees are quite resistant to fire it was impossible to destroy many in the face of the Japanese advance. Photograph from Black Star

these experiments, and the Department of Commerce, in an interesting publication on the history, production and manufacture of rubber, says that periodically unscrupulous inventors and promoters have advanced fantastic schemes for making synthetics in which natural rubber was secretly introduced into the process.

On the other hand the legitimate experiments have gradually developed products more and more acceptable commercially, although there seems very little evidence as yet that they can compete in price in normal times of peace with the tree-grown product.

The World War and the blockade of Germany stimulated synthetic rubber experimentation; as did the period of high prices after 1925 in connection with the Stevenson restriction plan, a British-Dutch agreement regulating rubber production and thus holding prices at a high level. One American company has spent fourteen years in developing its particular synthetic product.

But it will probably be well into 1944 before any large amount of synthetic rubber can be produced in this country, and then it may all be used by the military. It takes time to design, engineer and construct new plants. First comes laboratory experimentation, then pilot plants, then semi-commercial plants, and finally mass production. Moreover it takes time for the manufacturers to learn the technique of using synthetics in place of natural rubber.

It has taken a hundred years to develop present rubber products from the natural material. The comparatively new synthetics have different properties and cannot be automatically substituted for natural rubber, as many people seem to think.

It is true that synthetics are superior in resistance to oil, heat, oxidizing agents and its reaction to gases. Natural rubber, on the other hand, is superior in elasticity and rebound, extensibility, and in resistance to stiffening at low temperatures. With the enormous amount of research work now under way it is possible, of course, that the qualities of synthetics may be improved. At any rate the manufacturers are working desperately hard to adapt them to military uses where large quantities are needed.

Germany had built up a very large capacity for the manufacture of Buna (synthetic) rubber before it entered the war. But it has resorted to several desperate measures to add to its small stocks of crude during the conflict, which is further evidence that synthetics do not constitute the whole answer.

On the other hand the quickest form of relief, next to reclaimed rubber, lies in an increase of synthetic production, and a large dependable supply can be had in this way much sooner than from guayule or any other kind of farm-produced rubber.

But there is another reason why synthetic production should be expanded very extensively, even at heavy cost. We do not want again to be dependent upon the Far East.

Nor should we be wholly dependent even upon Latin-America, friendly as our relations with the countries to the South are. For it is possible that the Far East and Latin-America might combine some time in the distant future to make us pay twice what the rubber we need is worth.

Before leaving the subject of synthetics let us note that, strictly speaking, there is no such thing as synthetic rubber, although there are numerous rubber-like materials (Neoprene, Thiokol, Buna, Koroseal, Butyl, Ameripol, Chemigum, Vinyon, etc.). These products are called synthetic rubbers. Some chemists insist upon more exact terms, such as "artificial rubbers," "substitute rubbers," "synthetic elastics" and "rubberlike polymers." Another suggested name is "elastomers," with individual type names of "elastoprenes," "elastolenes" and several others.

William C. Geer, former vice-president in charge of research of the B. F. Goodrich Co., in a recent article in *Chemical Industries,* says that the rubber industry is afflicted by a confusion of terms. It has been perplexing enough to use such terms as pure gum, raw rubber, Para rubber, crude rubber, natural rubber and vulcanized rubber.

Yet even more uncertainty has been brought into the language by the several varieties of synthetic product, all of which possess some of the obvious physical characteristics of natural and vulcanized rubber, no two of them being exactly alike, however, and all of them having different trade names and being chemically different from natural rubber.

At any rate no one can say there is anything overstandardized about rubber! Each of the major companies is said to have about 800 different recipes for tire rubber alone.

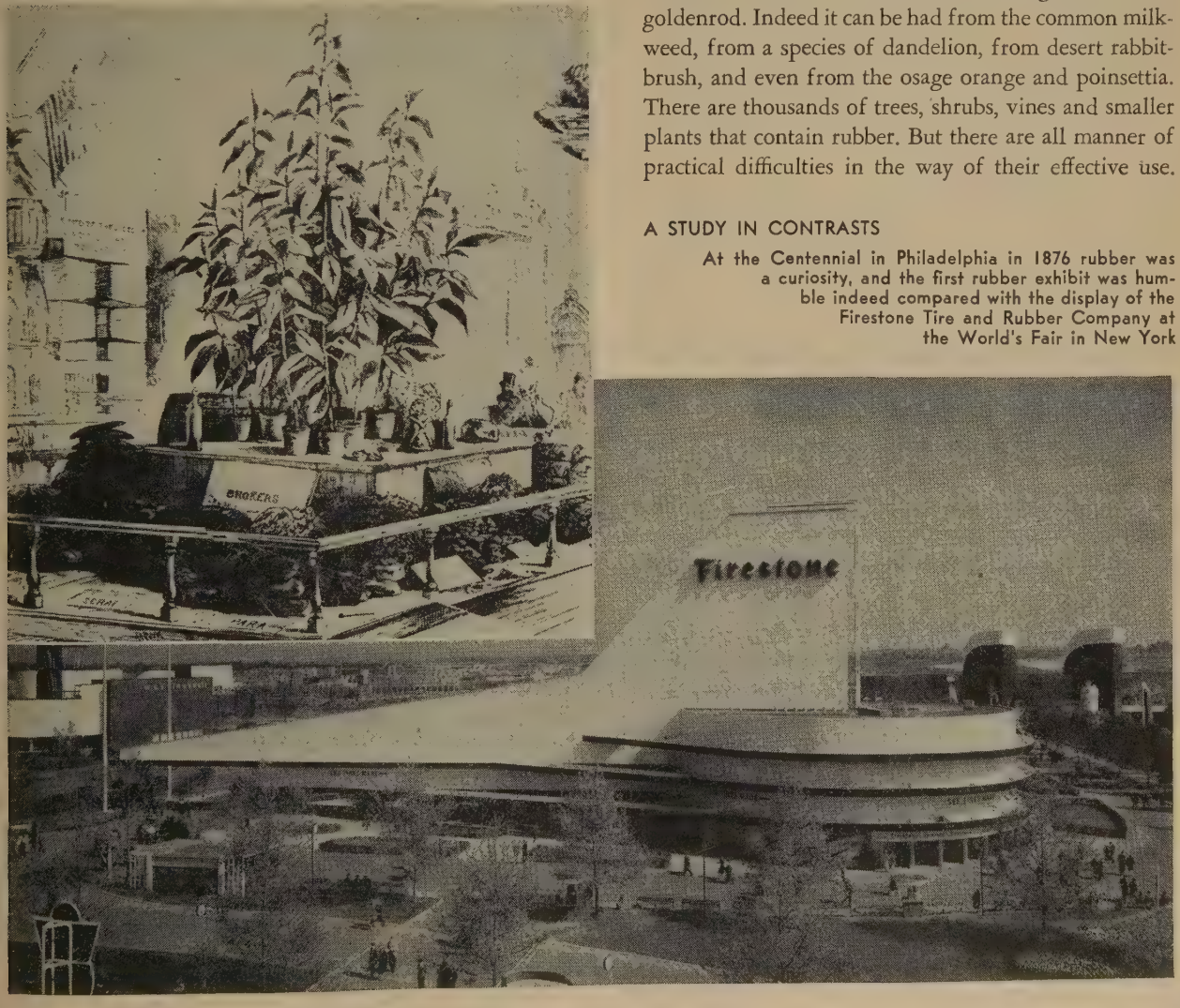
Turning to dependable and additional sources of the natural product, much public attention has been directed to guayule, a rubber yielding shrub that grows wild in northern Mexico and has been studied and cultivated in California. The plant requires four or more years to mature, when it is pulled up, roots and all, and the rubber obtained by processing. Because of resin content its quality is not quite equal to *Hevea,* but it can be deresined at additional cost.

The wild guayule in Mexico has been a producer for many years on a very small scale. Apparently there is nothing to prevent a larger scale production of guayule rubber from cultivated plants in the southwestern part of the United States. But the costs would probably considerably exceed that of bringing Para rubber from the tropics of South America, and no large supply could be had in less than four years.

Many references have been made to the experiments of the late Thomas A. Edison in extracting rubber from goldenrod. Indeed it can be had from the common milkweed, from a species of dandelion, from desert rabbitbrush, and even from the osage orange and poinsettia. There are thousands of trees, shrubs, vines and smaller plants that contain rubber. But there are all manner of practical difficulties in the way of their effective use.

A STUDY IN CONTRASTS

At the Centennial in Philadelphia in 1876 rubber was a curiosity, and the first rubber exhibit was humble indeed compared with the display of the Firestone Tire and Rubber Company at the World's Fair in New York



In the case of goldenrod the quality is only half that of *Hevea* and only a small amount of stock of improved strains is available, the use of unselected goldenrod being out of the question. In the case of milkweed the rubber content is low and methods of extraction have not been worked out.

On the other hand the rubber content of rabbit-brush is relatively high, but the labor of gathering it from available stands, which are limited to local areas and scattered over six states, would be enormous. In the case of so many of these suggested plants the rubber content is small or the cost of collection prohibitive. But renewed research into all such possibilities has been tremendously stimulated of late and no one can predict the result.

It is also likely that if transportation and labor conditions could be improved and if prices were allowed to rise, a considerable increase in production could be had from the wild *Hevea* trees of South America. This was the world's chief source of supply until after 1912, and in that year 49,000 tons came from Brazil. This, of course, was before the use of the auto was so widespread and the world's needs had multiplied.

For 2000 miles along the Amazon and up its nearly forty tributaries are many millions of *Hevea* trees. True, the jungle is overrun with countless vines and creepers, and infested with snakes, and many poisonous insects. But if the demand is great enough these conditions can be alleviated.

On the other hand by far the best source of natural rubber is not the wild *Hevea* but the cultivated tree, and there is no reason why this should not be raised on a very large scale, not only in Brazil but in other parts of Latin America. The tall *Hevea* trees develop slowly and have a relatively long life; it would take from seven to fifteen years to produce large quantities of rubber in this way, but as a long range program there are great possibilities in plantation rubber in Latin America.

While the cost might be somewhat higher than that of Far Eastern rubber the insurance against complete domination of supply by European or Asiatic sources is worth something. It would give the South and Central American peoples the exchange with which to buy our manufactured goods after the war, and bring the northern and southern parts of the Western Hemisphere still closer together economically than they are today, a consummation urgently desired.

At the time when *Hevea* plantations were expanding so rapidly in the Far East, attempts to cultivate the same tree in its native surroundings were almost entirely failures because of a fungous leaf disease. In its native environment, in mixed stands in the forest, where *Hevea* is protected by a wind-break of other trees, it is only lightly attacked by this indigenous malady, but when closely spaced in plantations, epidemic conditions are set up.

To make matters worse from the viewpoint of the Western Hemisphere the disease did not follow its natural host to the Far East; the seeds taken there were without the fungus. Malaya and the Dutch East Indies had diseases of their own, but not as serious ones.

In addition extensive research was carried on in the Far East, and, according to Dr. E. W. Brandes, head pathologist in charge of the Department of Agriculture's special rubber project, it was neglect of research on disease problems by the interested countries in the New World that may be charged, as much as any factor, with the loss of the once important, lucrative rubber industry.

Dr. Brandes also says that the leaf disease may have been responsible for the tradition, deeply intrenched in the minds of the seringueros of Amazonia, that it is impossible to cultivate *Hevea*. But the finding and segregation of high yielding individual trees is one of the outstanding contributions of the Far East, and in the same way trees may be selected or bred for intensification of resistance to leaf blight as well as for other objectives.

A number of years ago several of the rubber companies and one of the automobile companies began to develop rubber production of their own in various parts of the world. Possibly the motive was not so much fear that war would cut off all supplies as that America might be subjected to crippling international cartels or restriction plans by the British, Dutch and French governments, the British Stevenson Act of 1922 being an example.

In fact several of the largest of the American-owned plantations were in the very area that has now been occupied by Japan. On the other hand, the Firestone Tire & Rubber Company has a plantation in Liberia from which it gets a considerable part of its requirements, Ford has a plantation in Brazil, and the Goodyear Tire & Rubber Company has plants in Panama and Costa Rica. True, much of the work has been devoted to experiments to develop leaf blight-resistant stock combined with that of high yield, but recently the Goodyear Company announced that "we now feel warranted in an optimistic expectation regarding future results."

In 1940 Congress appropriated $500,000 for the Bureau of Plant Industry to make an exhaustive study of cultivated rubber in the West Indies, Mexico, Central America and South America. Already nurseries are being established, and seed obtained and moved from country to country, as required. This is a cooperative project that involves not only the companies already having experimental plantations, but some thirteen countries, and it may be said that the finest cooperation is being had from all concerned.

Such then are the possibilities in the way of rubber production either in this country or in Latin America. What is the net result of this picture? A categorical answer is difficult. The best one can say is that the outlook is very dark but not absolutely black. Probably the best summary was contained in an official statement some weeks ago by Jesse Jones, Secretary of Commerce, and Donald M. Nelson, chief of the War Production Board:

"Because some foresight was exercised, our military needs during the next couple of years can be met—provided that civilian use can be held to the absolute minimum."

Notice that these two authorities do not say that "much" foresight was used; they (Continued on page 276)

What, when you search your faith, your conscience, your religion, do you feel—

We Are Fighting For...

By STANLEY HIGH

At first reading this article may seem apart from the scope of Nature Magazine; inappropriate in a publication whose field covers natural resources. Yet there is no greater natural resource of a nation than its people—their faith, their moral fibre, their individuality. In this article Stanley High, distinguished writer and thinker, presents thoughts to which we regard it a privilege and a responsibility to give currency through our pages. In times like these it is the task of each individual to reduce to terms his own convictions. We feel that this article is a stimulant to the thought necessary to such vital mental activity.

THE war is nearly four months old and we still are told that "Production Will Win the War." Before the tide turns we will learn, I think, that production will not win the war. Only production—plus many other things—will win it.

Production triple plus is not something that comes on a dotted line at the end of a contract. It is something that must proceed out of the hearts of men. Our brains and muscles will never be *that* good until our hearts and spirits are. After four months, our biggest tooling-up job is still internal.

There may be many reasons why that job has not been completed long before this. The reason that I most frequently meet up with—in wide travelling through the country—is uncertainty and confusion as to what you and I, average citizens, have at stake in this war. We are not sure, to put it in the crassest terms, what we are due to get if we win this war; what we are due to lose if it is lost. What is it we are fighting for and what are we fighting against? Every American will have to work out his own answer to that question. I should like, here, to offer mine.

There are, I believe, a number of things—often described as war-issues—for which we are *not* fighting.

We are not, as some defeatists tell us, fighting to save the British Empire. Regardless of who wins, that Empire, including the Dominions, will look very different at the end of the war than it looked at its beginning. India is on the way to self-government. Australia and Canada are sure to find themselves at least as closely knit to the United States as to Britain. British colonial possessions are due to find themselves with a changed status, and the power in the British Isles that was once sufficient to control them will almost certainly be diminished or modified.

We are not fighting to save the British Empire because, as it was in September, 1939, the British Empire is past saving.

That does not mean, however, that we—average Americans—have no stake in the British Empire. If we believe in freedom and desire to preserve it, we have an enormous stake. For the fact is, that multiplied millions of the earth's population today are lining up on the side of freedom, not because of any process of democratic free combustion. They are lining up on the side of freedom—on our side—largely because of the example of and their contact with the British.

India, for example, is still some distance short of freedom. But the fact that, in the democratic sense, India desires to be free is largely because the British in India, for all their shortcomings, helped to introduce the Indian people to the idea of freedom. Around the world, there are vast numbers of people whose first awareness of what is now referred to as The Four Freedoms came with the British. They brought justice, order, security, the beginnings of education, and religious beliefs which helped to prepare the way for the great surge toward self-government that is now upon us.

Under Britain—giving due allowance again for British faults—these peoples were faced in our direction. The desire was awakened in them to go our way. We know that under a generation of Japanese-German domination they would be going in an entirely different direction.

We are not fighting to save the British Empire. But we give that Empire its due. And we say that, whatever the war does to it, we are fighting to see that the British Empire does not become the German or the Japanese Empire. For reasons of self-interest, if for no other, we want those millions on our side.

Also, despite the hate-barrage that is now being laid down, I do not believe we are fighting this war for revenge. We do not need to fight it that way to win. If we do fight it that way we may find in the peace that it was not worth winning.

The best hating of the last war was not generated under the military tunics of the men who did the fighting. It was generated under the stiff shirt fronts and in the bedecked and ample bosoms of those whose fighting was vicarious and who spilled their blood by proxy. Hate makes some men good fighters. But hate is not necessary to make good fighters of Americans.

Hitler's men, to be sure, fight on a diet of hate. They fight that way because they have nothing better to fight on, and because a hate-ruled world is what they are fighting for. Americans have fought and won without hate,

and will fight and win that way again because, in the American gospel, hate is not worth fighting for and a hate-ruled world is what we are fighting against.

Moreover, hate may doom the peace. After the bitter experiences of the last twenty-five years we ought to know by now that war and peace are indivisible. The way we make and keep peace has in it the stuff with which we make or avoid war. The way in which we fight the war has in it the stuff with which we make and keep the peace.

If, to arm us for this war, we equip ourselves with Hitler's hatreds, then one day we will find that the hate we bore helped us to build Hitler's kind of world. To build a better world than he would build we will have to fight a better war than he fights. I think we will. I think we will because, as Americans, we go armed with something better; because all that we are pleased and proud to call our faith—that better thing—is better enough and big enough to include in God's good time even the men we fight against.

"Totalitarians have declared revolutionary war on the West because they know that until the old faith is destroyed this new faith cannot be finally established, or the program of domination—which that faith holds as its reward—successfully reach its consummation."

There is a third issue—frequently raised—which is *not* what we are fighting for. I do not believe that, primarily or chiefly, we are in this war to save our economic skins. I do not believe we are in it, even, to save unchanged—like the faith once delivered to the saints—our economic status quo.

Our economic skins are not likely, soon again, to be what they once were. The economic status quo, if you mean by that the principle and practice of every-man-for-himself, which prevailed up to the first World War and reasserted itself in the middle twenties, is likely, also, to undergo considerable further change. For those whose faith in democracy is wholly dependent upon certain ways to make money and keep it, the times ahead are sure to be full of complaint and sorrow.

It is a notable phenomenon of recent great crises, like the present one, that their chief beneficiaries have not been the "Mr. Bigs", but the "Little Fellows". This is not to say that a holocaust is an essential prerequisite to the advance of what, in Europe, might be called the "proletariat". It only means that today, the people who inhabit the lower income brackets are better placed than ever before to turn the reshaping aftermath of such a holocaust to their own account.

The trend toward that situation got under way as far back as the turn of the Century. It has been making headway ever since. It is an inevitable consequence of the operation of our democratic system. Free schools, free churches, free platforms and a free press have got in their liberating work. The "mass" of the people are no longer a mass. They are individuals who are too good Americans to accept as inevitable the economic lot to which some of them are consigned, and are too well informed to believe that such a lot, in an America as richly endowed as ours, is necessary for anybody.

When this war ends, the "Little Fellows" all over the world—and in the United States—will be more potently placed than they have ever been before. I do not believe that we are fighting to save the economic status quo, unchanged, because I believe that, in the face of the power and intelligence of the average man, it is past saving. I believe that wisdom and far-sightedness enough on the part of those who are higher in the economic scale can direct that power away from the destruction of capitalism and toward its adjustment into a system that will be increasingly productive both in material and in human values.

These, it seems to me, are some of the things which we are not fighting for.

To know what we are fighting for, it is necessary to ask what America is all about, anyway.

Not the safety of their own skins, and not convictions suddenly or lightly arrived at, but something from very deep roots was stirring among the men who drew up the Declaration of Independence and, even more insistently, among the aroused people for whom they spoke. They put human personality at the center of the pattern they drew. They did that because human personality was already at the center of their way of thinking, believing, and aspiring. And the quality that distinguished the nation they founded—and amazed the world—was its painstaking determination to judge its practices and appraise its institutions in terms of the way in which, through them, personality was served and developed. Man did not exist for the state, but the state for man.

This—a moral order issuing, on the human level, in personality values—is the essence of what, as Americans, we can call our faith. It is in relation not to our politics, or to our economics, but to those religious conceptions that the totalitarianism with which we are at war is in most violent conflict with our civilization.

The creed of Hitler is designed to exalt a way of thinking, believing, and aspiring in total contradiction to that which Western man has been struggling to establish and which, in the political sphere, was most nearly realized in American democracy. The civilization of Nazism does not condone force, but exalts it to the status of divine law. There is in it no brotherhood of man, only a brotherhood of Germans. The golden rule is not a preached but a widely neglected ideal; it is repudiated as neither a rule nor golden. There is no second great commandment; the object of the first is Germany. Its god questions Cain only to praise his answer. The forerunners of the gospel of human personality are not called prophets; they are called "unfit" and their gospel branded as a "Jewish plot". The greatest prophet of that gospel is not called "the Son of God". He is called "a preacher of weakness who met the death of a common criminal".

The end is a society in which man is no longer a personality but an anonymous digit. As a person he is lost in the mass of digits which makes up the power of the state; the supreme good. The more completely he is lost,

the greater is his virtue, according to Nazi dictates.

Here, in short, is a complete reversal of all that the modern world has been struggling for. Here the state no longer exists for man, but man for the state. Here, moreover, is a pagan reversion that is backed not only by physical force but by the sanctions of religion and morality. Other tyrannies kept men slaves by reason of external compulsion. There has never before been a modern attempt to convert a whole nation to the moral desirability of slavery.

Totalitarians have declared revolutionary war on the West because they know that until the old faith is destroyed this new faith cannot be finally established, or the program of domination—which that faith holds out as its reward—successfully reach its consummation.

Now what do we possess by way of resources adequate to meet this threat? Our American faith, for all our frequent neglect of it, has bred in us two qualities which, taken together, are the American character. These two qualities have brought us—through peril, toil, and pain—from precarious beginnings to our present national stature. They have seen us through previous crises. There is no reason to believe that, revived and potently combined again, they cannot see us through this one.

"Hitler's men . . . fight on a diet of hate. They fight that way because they have nothing better to fight on, and because a hate-ruled world is what they are fighting for. Americans have fought and won without hate, and will fight and win that way again because, in the American gospel, hate is not worth fighting for and a hate-ruled world is what we are fighting against."

First of all, our faith in a moral order, with human personality at its center, preserved and developed in the average American a sense of his own importance. Self-confidence became, as a consequence of that faith, an American characteristic, albeit not always a pleasant one. This was truer here than in most democracies. For here the forerunners of our freedom were Puritans. The Puritans laid great store by the doctrine that, high or low, man was made in the Divine Image and had in him something of God. They practiced that belief. In the presence of kings they were sure of themselves. Independence came easily because in spirit they were already independent. God, they said, cannot be pushed around.

A second quality has been bred in us. The faith that led the average American to believe in himself was inclusive, not exclusive. It required him to believe in his neighbor as in himself. However dubious some of its signers may have felt about such lack of discrimination, the Declaration of Independence did not pick and choose. It said "all men". In view of the way of thinking, believing, and aspiring which, from Massachusetts to Carolina, was the most important thing Americans had in common, it could not have said less and survived.

By and large, American thought ever since has stood pat on that inclusiveness. Thus, along with his self-confidence and derived from the same source, the character of the average American has included social confidence: the conviction that the other fellow, given half a chance, would come through.

For our own defense—if for no better reason—that part of our American faith needs reviving. To act now as though it were every man for himself and the devil take the hindmost, is treachery. It is no less treachery to act as though it were every bloc for itself, or every minority or every special interest. The unity, like the effort, required for this crisis cannot be exacted from us. It will come when we say of our remotest American neighbor: "He's good. He's got what it takes".

Americans, with that religion revived in them, are no more likely to be overrun by their foes than, from Buckingham Palace to East Ham, the people of London have been.

The Nazis are right. They are right in the belief that if the Western world is to be made over those qualities will have to be destroyed. They give every indication of knowing that this is a large order, and of laying their plans accordingly.

It may be an even larger order than that. The history of the character of this Western person is reassuring. It reveals in him an amazing capacity to remember and, remembering, to snap out of it. This capacity—this down-but-not-outness—did not come by chance. Its development has been the supreme and, through thick and thin, the unsurrendered concern of his religion. To reassert it in the face of this present crisis is to provide both the best defense for our American faith and the latest proof of its validity. It is, in brief, to know what this war is about, and—at whatever material and human cost—to have the stuff it takes to win it.

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On The Beam

By H. A. Bolz

The bat, sans aid of instruments
  Or ken of lift and turbulence,
Flies blind and without diffidence,
Flies blind, in fact, with confidence,
  Detecting obstacles by sense
Of supersonic measurements.

The ovenbird on its way home encounters—

TRAFFIC

By RAYMOND S. DECK

Illustrated by R. Bruce Horsfall

"THE STUPID BIRD FLEW ACROSS THE HIGHWAY TOWARD THE HAWTHORN. IT SHOULD HAVE LOOKED BOTH WAYS BEFORE IT STARTED, AS CHILDREN DO."

It was only a silly bird, of course, that smacked against your hurrying automobile. That is not like hitting a chicken that belongs to someone. You do not have to stop and answer questions when you hit a little brown bird. Besides, it was not really your fault. Driving so fast, you hardly could have avoided that smudge on your windshield, the fluff of feathers lying in the road. I know. I do a lot of driving. Not long ago I, too, hit an ovenbird.

It was in mid-spring, I remember. Drifts of budding roses lined the parkway. I recall a clump of shadbush on the south; and across the road, a hawthorn in snowy flower. The stupid bird flew across the highway toward the hawthorn. It should have looked both ways before it started, as children do. There was an insignificant smack as the car struck the creature. Of course I kept right on going, and the ovenbird was snatched away by the wind. In the mirror I saw it whirl like a pinwheel to the concrete. The next car mashed it as flat as a piece of paper.

That should have closed the incident, but, somehow, it did not. On balmy spring days the Northern Hemisphere is flooded with feathered fliers. It occurred to me that the dead ovenbird had been returning from green jungles thousands of miles away. In another day or two it would have completed a journey from Colombia, or Venezuela, perhaps, to shadowy forests north of Montreal.

It had flown south from some such Canadian wilderness, I reflected, or from a sunny woodland in the States, seven or eight months before. The flight to the jungles had been the answer to a strange compulsion. An ancestral yearning, mysteriously emerging from the misty past, had pulled the ovenbird off through the night sky, although the flier did not know that.

The bird never knew why it wanted to leave its nesting land. The sun still had shone warm and bright when September came. There were hosts of insects crawling over leaves and flowers. Yet something of a sudden cried "Go," and off it went. It flew by night through skies ablaze with stars; it rested and fed by day in woodlots and city parks. Nearly always, when twilight fell in sparkling weather, the ovenbird leaped up and flew away.

No doubt the bird paused uncertainly when it reached gentle Carolina, for there great numbers of its cousins, the myrtle warblers, spend every winter. But the voice within it commanded, "Fly on; fly on." Again it sought peace by the shores of the tropical Gulf, but there was no peace. It sprang into flight again, whipped south over naked oceans toward the Southern Cross. The towers of great cities were only memories now. Far below drifted the thatched huts of leaves of roaming Indians. Monkeys raced along branches as gray squirrels lately had raced.

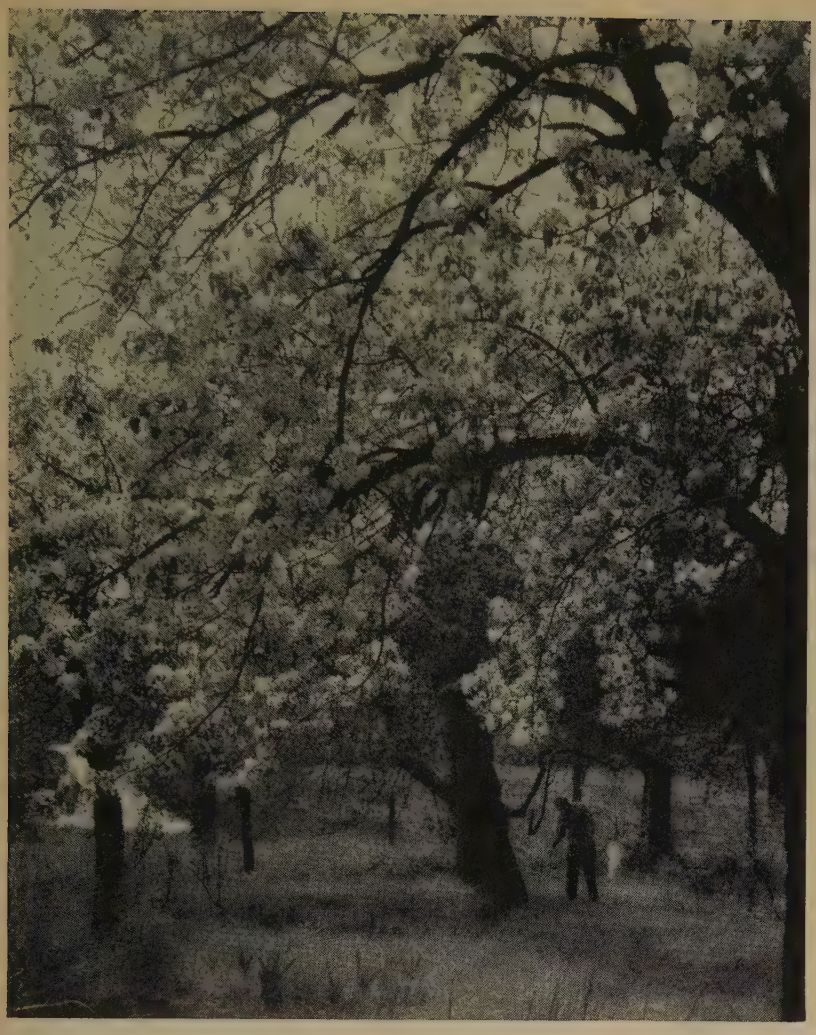
Then the urging fires of migration sputtered and died. The ovenbird set its wings and dropped out of the sky to dally in the shade of sun-curled palms; to live for a while as its fathers had lived—from equatorial insects.

Those winter weeks passed among the blooms of hothouse flowers were happy ones. But unrest at length came stalking into the jungle. The spinning earth in its course had floated far through space. Momentous things were happening in the ice-bound North. The coals of migration started to glow again. Something within the ovenbird whispered of hawthorn in thick, wet bud; of sunlight filtering through maple twigs dripping sap. "Teacher," the brown bird sang hoarsely by way of experiment. "Teacher?" it asked—and, hearing an answer, for all I know, flew north into the night.

Of course the ovenbird did not remember the wildflowers that had lighted its northern woodland in longgone May; nor redstarts fluttering among the velvet leaves of waking oak trees. It is doubtful if the bird could recall even the dutch-oven nest of grasses beside a tuft of ferns.

I suppose that even momentous things fade quickly from a wild bird's heart, for birds can not think, so stern scientists tell us. But ovenbirds must surely remember the songs they sing in spring. An echo must sound always in their ears of the gay-whistled *teacher, teacher,* which rings through North American woodlands in May and June. They never could forget the ecstasy of wake-robin time, which sends them aloft to shower the earth with silver melody. Ovenbirds, even in far winter jungles, must remember the skeins of song they spin in spring.

Smack! It was an unpleasant little thud that sounded as the ovenbird flew north across the highway on that day last spring. Sometimes a stupid bird can make quite a nuisance of itself to a man, the master of a modern car.



An orchard hillside bordering a swamp furnishes the setting for—

The Story of an Insect Garden

By EDWIN WAY TEALE

Photographs by the Author

This is the first of three articles by Mr. Teale, seen with an insect net beneath his apple trees. These and other adventures will be included in a book to be published this fall.

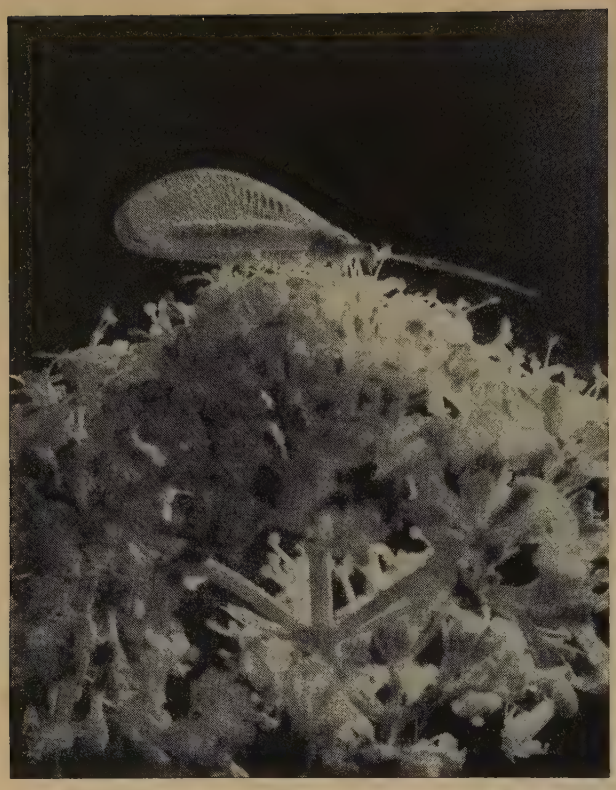
PHOTOGRAPHING the activity of insects has been a major interest of mine for more than a dozen years. I soon discovered, however, that a man lying full-length to get a better view of an ant hill, or squatting down to peer into a grass-clump, attracted as much attention as a man standing on his head in a highway. So, I began looking about for some secluded spot where I could work without disturbing my neighbors or endangering my reputation for sanity.

I investigated several sites. One was a field surrounded by high trees. Another was an island near the shore of a small lake. Another was a nut grove—the appropriateness of which my friends were quick to point out. Finally, I discovered, not too far from home, an orchard hillside that slants away from a gray, weatherbeaten barn to the border of a swamp, where acres of cattails become a tumbling green sea on a windy day.

Midway down this slope, between the gnarled trunks of apple trees so old they first bore fruit when Abraham Lincoln was President, I have planted an insect garden. Here, I have set out orange milkweed, butterfly bushes, mallows, hollyhocks, honeysuckle, verbenas, lilacs, sunflowers, button bushes—things that the insects like. And here, during the leisure time of six summer seasons, I have explored with a camera and a magnifying glass the strange and fascinating world of my six-legged guests.

Each year, when spring comes around, I engage in a unique transaction. For certain moneys—to be exact a very few dollars—I purchase the insect rights to the hillside. I do not eat the apples. That is, not many apples. I do not chop down the trees. I do not destroy the fences or cut down hay or dig wells. I simply spade up some of the sandy loam between the ancient apple trees and add buckwheat, morning glories and other annual plants to the banquet which I have already spread for my insect guests. Nine-tenths of all the visitors attracted to this garden are interesting creatures that do little or no harm to man.

As you walk down the weed-lined path of this insect Eden of mine, you encounter brush-piles for bark beetles; a miniature Sahara of open sand for ant lions and digger wasps; a heap of moldering fence rails for carpenter ants; and an ageing pie-tin holding dabs of syrup for the delight of wild bees. The old apple trees, in themselves, are a paradise for insects. Some scientific census-taker has reported that they attract five hundred different species. Knothole caverns, grassroot jungles and wild cherry tangles provide additional inducements. There are features to attract sand dwellers, leaf dwellers, bark dwellers; creatures of the swamp, the weedlot, the meadow; inhabitants of the shallow water; and dwellers in the insect underworld among the weed-roots of the hillside. And, at the foot of the slope, where a slow, brown stream cuts its winding track through the sweet flags and cattails of



The delicate, pale-green lacewing fly rests its wings on an hospitable blossom, while next to it is a dragonfly on a leaf of sweet flag. Below, a leggy crane fly hangs from a bit of twig. In the shade of the ancient apple trees these insects dance up and down or cling to the lee side of the trunks on windy days. In the insect garden many insects find hospitality and blossoms and other attractions designed for them. Few of them do any harm to man although most people drive them from the ordinary garden with sprays, dusts and poisons.

the lowland, dragonflies dart above the water and caddisworms construct their little cases among the rubbish of the eddies.

So far as I know, this orchard acre of mine differs from every other garden plot on earth. Mine is an agricultural problem unique in a land filled with agricultural problems. While millions of gardeners have been using dusts and sprays, Paris green and Bordeaux mixture, to get rid of bugs, I have been striving to increase the insect population of my hillside.

In this topsy-turvy effort of mine, I sometimes remind myself of an ant I once observed crossing a clothesline. The rope was stretched from an arbor to a maple tree, and was used as an aerial bridge by a colony of black ants. One evening, I saw a line of ants, looking like an insect caravan, silhouetted against the sky. They all were going North. Then I noticed one lone ant trying to go South. It bumped into other ants. It caused traffic snarls. Finally, it went to the bottom of the rope and proceeded blithely on its way walking upside down.

As the years have passed, I have come to know every cranny of my hillside. The Little Sahara, The Lincoln Trees, The Swamp Walk, Dragonfly Hollow—all have become as familiar to me as the rooms of my childhood home. Almost every spot in the garden recalls some moment of pleasure, or beauty, or drama.

Beside the oldest of The Lincoln Trees, one August afternoon, I saw three butterflies—a great tiger swallowtail, a red admiral, and a white cabbage butterfly—swirl upward in a battle royal, spinning as though caught in the grip of a tornado. Beyond, where short April grass covered the hillside, I observed a bumblebee queen, just out of winter hibernation, exploring a mole tunnel. She scrambled down through a break in the passageway and

A dark-winged damselfly clings to a curled-over leaf in the garden while next to it a praying mantis on a dried sunflower leaf struggles with a less fortunate dragonfly that is almost as large as the captor. There is drama in the insect garden, excitement and thrills and variety that lurks in such grassroot jungles as these pictured below. This is the jungle as seen from the point of view of the insect. Readers with bright eyes will be able to see, about the middle of the picture, a katydid climbing up one of the weed stems of the tangle.

reappeared again through another opening many feet distant. On the hard-packed soil of the hillside path, another time, I watched metallic-tinted tiger beetles hunting in the hot sunshine, running this way and that, so elusive and shy that they darted for cover when touched by the shadow of a cloud.

One June morning, just at sunrise, a pale green lacewing fly fluttered down on the petal of a rose, and, stooping, sipped from a round dew-drop that glowed like a pearl in the luminous dawn-light. Nearby, in late-September, I photographed a praying mantis clinging to a partially-dried sunflower leaf and struggling with a captured dragonfly almost as big as itself. Then, there was the great monarch year when these black-and-brown butterflies streamed across the garden on their long migration to the southern states.

Random recollections such as these come to mind when I think of past hours on my hillside. Wherever you look, from early in spring until late in fall, there is life and color and interesting activity in an insect garden.

Butterflies drift about on rainbow-tinted wings or hang on the drooping, purple blooms of the buddleia bushes. Tiny frog-hoppers build up their snow-white castles of foam on the stems of weeds and grasses. Ants are busily collecting honeydew from their herds of aphid cattle. Crane flies dance in the shelter of the apple trees. Cicadas shrill from the heights of the maples. Brilliantly-hued velvet ants run this way and that over the hot sand. Damselflies, with black wings and bodies of shining, metallic green, drift from bush to bush. And, in the high, feathery grass-clumps of the swampside, katydids and long-horned grasshoppers engage in a nightly serenade.

A whole new host of visitors come to the garden at nightfall. After-dark exploring with a flashlight reveals

At the slope of the hillside in the insect garden stands a weather-beaten barn, itself an attraction to various insects. It serves no purpose but as host to little creatures that enjoy such places.

their activity. One of the strangest sights illuminated by the beam of such an electric torch is the nocturnal feast of the female snowy tree cricket. This slender, ghostly creature, attracted by the melodious singing of the male insect, mounts his back and dines on a glandular secretion in two cuplike depressions behind his wings. The male cricket provides his lady-love with a feast as well as a serenade.

Moths by night and butterflies by day will flock about a tree-trunk that has been painted with a mixture of brown sugar and fermenting fruit. Most decaying fruits, but particularly peaches and bananas, will attract moths and butterflies of many kinds. Sometimes, in remote corners of the garden, I would place a bit of decaying meat to bring carrion beetles from afar, and, during several seasons, an artificial mud puddle, placed beside the hollyhocks, attracted the attention of mason wasps and sulphur butterflies.

Part of the fun of an insect garden is making friends with individual visitors. Butterflies and bumblebees, ants and dragonflies often return again to the spots where you first see them. They can easily be captured, marked and released. By dabbing little spots of different-colored lacquer on the backs of either night or day visitors, you are enabled to recognize them when you meet again. In this way, one summer, I discovered that a furry, black-and-yellow, September bumblebee was returning night after night to sleep in the blooms of the same cluster of hollyhocks.

Among these individual visitors to an insect garden, many are as strange and amazing in their habits and abilities as any creature that is encountered in the most remote tundra, or veldt, or jungle. They include animals that have ears on their legs; animals that progress along the ground by means of springy tails that catapult them into the air; animals that are born without mouths or stomachs; animals that are virtually immune to the most violent of poisons.

What jungle has a stranger inhabitant than the ant lion that always walks backward and uses its tail for a plow and its head for a shovel? Or the monarch butterfly that is able to taste with its legs? Or the honeybee that can see with the "black light" of ultra-violet rays? The strangest jungle in the world is the grass-tangle beneath our feet.

Imagining how this jungle appears to the insects; putting ourselves mentally in the place of the little bug that toils up a grass-stem or launches itself out into space, increases the fun of insect exploring. In "Fairy Forests," the English poet, Alfred Noyes, writes:

"I wonder if you've ever dreamed
In summer's noonday sleep
Of what the thyme and heather seemed
To little ladybirds that creep
Like crimson shimmering gems
Between the tiny twisted stems
Of fairy forests deep;
Or what it looks like as they pass
Through jungles of the golden grass."

Anyone, once he discovers the fascination of insect-watching—both with his eyes and his imagination—can know the thrills of exploring even in an area no larger than a tabletop. The activity of the insects becomes more absorbing the better we understand what is taking place around us.

Gilbert White's English (Continued on page 273)

Although the approach of the avocet to its nestful of eggs is similar to that of many ground-nesting birds, the size of the bird's body and its exaggerated form accentuate movements that one might miss in observing other birds of this group. Photographed by Edward Fox Dana.

Shore Bird Extraordinary

By OLIN SEWALL PETTINGILL, JR.

Photographs by Edward Fox Dana and the Author

Forty-seven species of shore birds inhabit North America. They are wading birds, usually with long, straight bills, long necks, long legs, and feet with four toes. Their plumage forms blending patterns of browns, grays, and reds, interspersed with some black and white. One of their number is so utterly extraordinary in shape, so large and strikingly colored, that it is a personality among its class. This is the avocet.

Bird of extremes, bird of exceptions, the avocet's legs and neck are excessively long, almost to the point of being grotesque; its toes are three in number and prominently webbed; its bill curves abruptly upward. Brilliant, reddish-brown colors of head and neck fade away to sharply contrasting black and white areas on body and wings.

For an abode the avocet has dual preference, either mountain-walled valleys of the far West or alkaline lakes of the great plains. In either it is ever conspicuous, always the spectacle.

Dead Dog Slough near Kenmare, North Dakota, is a typical prairie abode. Here the great rolling plains dip momentarily, leaving a shallow basin. Water gathers from spring rains and stands unreplenished, then becoming stagnant and highly alkaline. Under clear June and July skies it gradually evaporates, leaving an empty basin, white-powdered and desolate.

It is when the water has just appeared in the spring that the avocets gather here, at least a half-score of them. At first there is great activity. There are weird courtship antics when they lift their wings, lower their heads, and trip along liltingly in the shallow water, ecstatically circling and pursuing one another; harmless, but

form accentuate actions that might be missed in other birds.

Awkwardly the tall bird straddles its nest, placing its feet so that, when the legs are folded, its body will cover the nest. The eggs are turned with the bill, thus preventing the delicate membranes of the embryo from adhering to the shell walls. Any foreign matter that may have clung to the eggs is lifted off with the bill. The nesting material is hastily rearranged. These details have promoted the lowering of the breast feathers, thus uncovering the bare areas, or brood patches, of the breast. Finally the avocet, with its body still in the same position, lowers itself carefully, bringing the brood patches to rest on the eggs and letting the breast feathers fall as a canopy over them. Once on the eggs, the bird rocks back and forth over them to assure the perfect position of the protecting feathers.

When hatching time nears, Dead Dog Slough is half its former size and the nesting area lies far distant from the water. The adults gather there to feed. Now

quarrelsome contests as each pair—the marital bond once sealed—claims a section of shoreland for private use as a nesting territory.

A shallow cup is excavated in the gravel and sparsely lined with bits of vegetation. When four or five eggs have been deposited, the monotonous routine of four weeks begins, a routine that both sexes share.

The approach of an avocet to its nestful of eggs is not unlike that of any other ground-nesting bird; but the size of the creature and its exaggerated

In the picture above, the photographer, Mr. Dana, has caught the avocet in flight, wings sweeping. At the right, the author, Mr. Pettingill, pictures the avocet chick on the nest. There the youngsters remain for twenty-four hours or more, as they gain strength to leave the nest. Then, as the growth of the legs is almost fast enough to be seen, and the bills lengthen to match, they are soon foraging for the organisms in the mud after the fashion of their parents.

Here Mr. Dana has caught three phases of the acts of the avocet in taking over the nest. First the nest is straddled so that the body, when the legs are folded, will cover the nest. Then the bird lowers itself carefully, bringing the brood patch to rest on the eggs. Finally the bird settles firmly on its eggs, rocking gently to assure a perfect position.

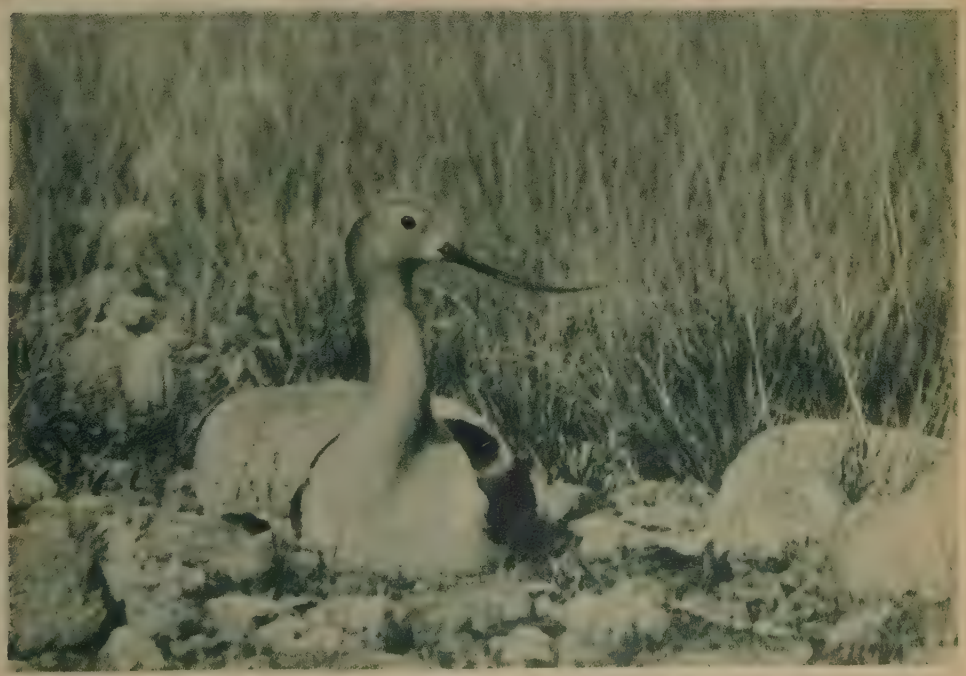
at a communal feeding ground, rivalries have been forgotten. As they search for food they tip their bodies forward, walk along steadily, and sweep their scythe-like beaks to and fro across the muddy bottom, stirring up and catching small organisms.

For fully twenty-four hours, or more, the newly-hatched, downy chicks linger in their crude cradles. From the yolk material still harbored in their bodies comes immediate strength, energy, and equilibrium. Sight, hearing and other senses rapidly near an advanced stage of perfection. They are soon capable of running at great speed, of crouching at the slightest danger.

During the days that follow the chicks are speedily transformed from ordinary appearing shore bird young to distinctive adulthood. The legs seemingly lengthen with each stride. The bills, notably blunt and straight at first, permit them only to dabble in the mud, shore bird fashion. Later, as the bills project and turn upward, the sidewise sweeping begins.

Why are avocets so curiously evolved in structure and behavior? And why do they often prefer alkaline sloughs, places not only limited in diversity of food but places that perennially present the hazard of an evanescent water supply? Probably competition in the scheme of Nature has forced avocets to accept places rejected by other birds and to adapt themselves accordingly.

Extraordinary shore bird —the avocet!



Two views of may-flies resting. At the left note the rigid position of the wings and other parts of the insect. In the picture above we have a good view of the head of the insect, notable for the prominent eyes. These are equipped to afford perception of movements even in dim twilight, but are not designed for a clear detailed view. The primary purpose of such visual equipment is to enable the insects to find mates under almost any conditions of light, and carry on the life cycle.

INSECTS OF ANCIENT LINEAGE

By ROMAN VISHNIAC

While we do not know exactly what the first insects on this earth were like, scientists who can read history of fossils in ancient rocks can reconstruct some of the past. An extinct order of insects known to science as *Palaeodictyoptera*—which means "ancient net winged"—is, perhaps, the oldest. Nearly as ancient were primitive cockroaches, dragon-flies and may-flies. And the last two bear certain resemblances to the "ancient net winged" clan.

Certain it is, at any rate, that the interesting may-flies of today can trace their lineage back at least to the Coal Age, when they performed their reeling dances in the dank and silent twilight of the ancient woods of prehistoric times.

Modern may-flies are now grouped in many families and include many species. Even entomologists disagree as to the exact distinctions between them. A few of the species have only one pair of wings. Many adult may-flies of different species live but a day or night. Some go under water to lay their eggs; others merely drop their eggs at random. Most have a long life cycle from egg to adult, as much as three years.

Most of the may-fly larvae have gills along each side of the abdomen. Their habits also vary, since some crawl about under stones in the water; some make homes in the mud; others are free-swimmers. They all, of course, provide food for fishes.

On these pages we see a series of pictures of events in the life of one species of may-fly, a European form. While no one series of pictures of a single species would cover all, there are certain similarities of form and habit of life throughout the group that are typical of them all.

The nuptial dance of the may-flies, taking place over ponds or rivers, is one of the oldest of love dances. It culminates in the continuance of the cycle of may-fly life. Upper right, we have a head-on view of the may-fly and an excellent picture of one of the interesting eyes. At the right the larva of the may-fly, still breathing through its thin skin. Note the feathery tail bristles and the way in which the camera has caught the tracheal platelets waving to stir up fresh breathing-water.

Food by the Roadside

By PAUL HADLEY

Photographs by the Author

There is food growing by roadside and fencerow, in vacant lot, country pasture, and murky swamp. It is free for the gathering. Many varieties of weeds, tasty and healthful, can be added to the human diet. They contribute nutrition, bulk, and vitamins, so necessary to a well-rounded diet. They are equally valuable for the home table or for camp fare.

Just when people began to eat "greens" is not known. Perhaps Mr. Caveman sent "the little woman" out to gather a mess of leaves from the forest to cook with their steak. We know that our Indians were fully versed in the uses of many plants for food and other purposes.

Among these was the familiar cattail. Gathered in the spring, the tender green shoots, broken in short lengths, may be cooked like asparagus. The heavy roots are rich in starch and sugar, and the Iroquois made from them a form of porridge, as well as a sweetish flour, and syrup for their corn-meal dishes. It would seem that the cattail definitely has food possibilities.

Widely known is the common dock, *Rumex crispus*, known also as yellow dock and sour dock. It is one of the earliest plants to put forth leaves. These, cooked, make good early spring eating, the curly-leaved variety being the best.

The Composite family includes several dietary possi-

Pokeweed, upper left, is a popular wild food in the South. The leaves are cooked for greens and the stems like asparagus. The roots are poisonous to some, as are the berries. The leaves of sow thistle, left, may be used as greens longer than most other weed leaves because they remain tender longer. A pest in the lawn, the broadleaf plantain, below, is good as greens, although not widely used. Since the stems of the leaves are somewhat stringy, they should be used only while young.

Wild lettuce is familiar to most of us. It is a true lettuce, as is revealed by its odor and flavor. Bitter when eaten raw, this quality disappears when the leaves are cooked. It grows widely, frequenting fencerows and orchards in most parts of the country.

For those who like a sour flavor the leaves and stems of violet wood sorrel may well be included in a mess of greens to add a gustatory bouquet to the dish. Too much of this should not be included because oxalic acid is said to be bad for digestion.

bilities, such as dandelion, wild lettuce, sow thistle and hawkbeard. Dandelion is widely used, and deserves more popularity, especially in parts of our West and over much of central Canada, where it achieves a luxuriance of growth unknown in our eastern states. Its cousin, wild lettuce, *Lactuca*, also deserves more attention than it has received. Sow thistle is coarser but edible, while the hawkbeard is too tough and "stemmy" to be popular.

A relative of watercress, peppergrass, *Lepidium*, is a common weed of the roadside and, gathered before it has grown tough, is one of the best weeds for greens. It is also known as chickweed, tonguegrass and wild mustard, and is inconspicuous. It can be recognized by its odor and taste, which so closely resemble those of watercress.

Lambs-quarters, *Chenopodium*, with its dark green triangular leaves, with a frosted appearance on the undersides, is common and often found in gardens. Some gar-

The common dandelion, *Taraxacum*, is an old standby among greens. It makes good, healthful eating when cooked with bacon or salt pork. Soaking overnight, or a preliminary boiling, will remove the excess bitterness. It is one of the earliest of our green plants and is best early in the season before the plant's blossoms have ripened.

The little Venus' looking glass is found growing wild and weedy in a variety of places. Look for these plants with their little whorls of round leaves and deep-violet, star-shaped blooms. It is sometimes called mouse-ear. Use young; it grows tough with age.

Peppergrass, also called chickweed and tonguegrass, is a member of the cress family. Its young stems have a pungent, biting flavor. As a green it should be eaten while young before it becomes tough and stringy. It can easily be recognized by its odor and taste.

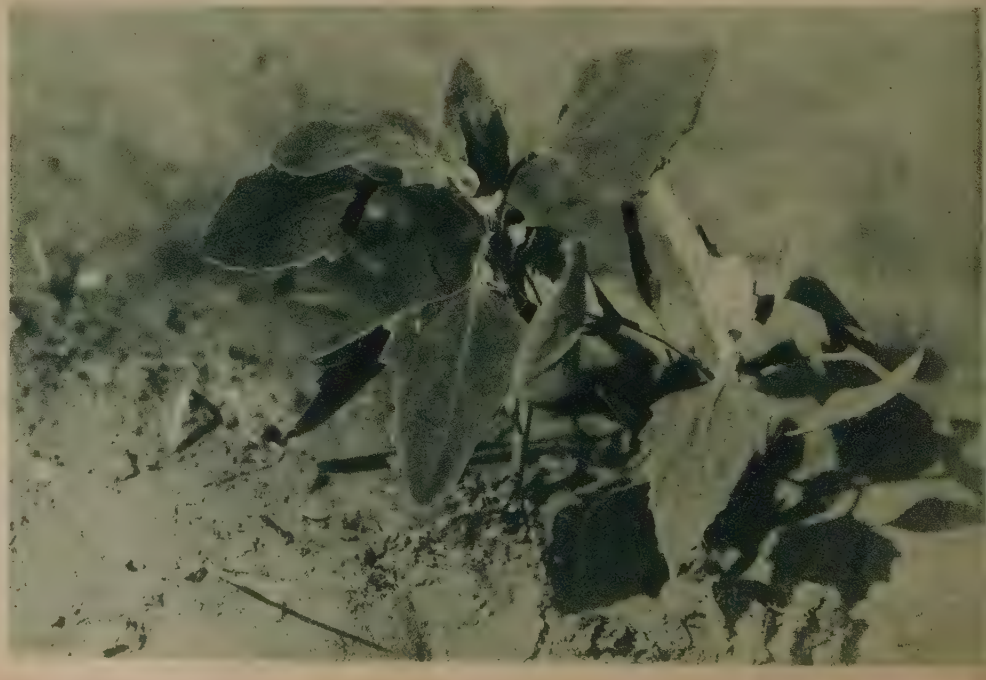
deners let it grow for its value as greens for the table.

The common purslane, *Portulaca*, has its merits as a table vegetable. In fact, some gardeners will tell you that the only way to get rid of this weed is to cook it.

Pokeweed, whose value as food was described in the February, 1942, issue of Nature Magazine, is a prime favorite in the South. It can be used over a period of three months; cooking in two waters gives best results.

Those liking greens with a sour taste will turn to the leaves of wood sorrel, *Oxalis*. Most of us, as children, have eaten these leaves raw. A few leaves of the violet wood sorrel, which is rich in oxalic acid, may be added to a mess of other greens and will give to it a pleasing sourness. The yellow wood sorrel is less sour and of poorer flavor.

Experimentation on the part of housewives will probably be necessary to discover the best methods of cooking these greens. Also some trials of combinations of different kinds of greens are necessary for best results.



Lambs-quarters is a well-known weed, and is often found in cultivated gardens where the gardener may grow it for greens. It can be recognized by its "frosty" appearing leaves, the under sides often being violet color. Good as greens while young, but it soon grows tough.

As We See It

LET'S LAY ★ ★ ★ OFF THE DUCKS

"With every ounce of explosives needed for the defense of America, why should vast quantities be wasted this year in duck shooting?" Why, indeed, would be our answer to this question put by the Emergency Conservation Committee. In fact, we had planned to put this question editorially ourselves.

The Committee asks all "who want American fire power concentrated against Japan and Hitler" to urge the Secretary of the Interior to recommend a closed season on waterfowl in 1942. "This," the statement adds, "will be for the benefit of the country, the hunters, and the ducks. It has been estimated that one closed season will do as much for the restoration of waterfowl as five years of strict regulation of hunting. This is a year when everybody, conservationists and hunters alike, should favor a closed season. Duck-shooting now benefits only our nation's enemies."

We agree heartily. If there ever was a time when we should have a closed season, and thus prove what such protection will accomplish, it is in 1942. Now is the time when offensives against ducks and geese—and, indeed, against other wildlife—should be adjourned. The only offensives we should have are against the enemies of our country.

We have seen inconclusive statements and even more inconclusive figures, during the past several years, to support the contention that migratory waterfowl are increasing markedly. Neither words nor figures have been convincing. These glowing reports are not, for example, substantiated by such recent statements as that of the Florida Commission of Game and Fresh Water Fish. Commenting on reports of many ducks in Louisiana, the Commission expresses sore disappointment at the numbers of ducks that have come down the Atlantic flyway. It says: "Not that there haven't been some ducks—but they haven't been so plentiful, according to reports from nearly every section of the state."

Yet the United States Fish and Wildlife Service has not come forward with any admission of scarcity. To do so would be to give the lie to earlier optimistic reports. Such instances as this—and there are others—convince us that the facts and figures presented represent wishful thinking more often than real plenty. The whole administration of the Migratory Bird Treaty Act, and the promulgation of regulations under it, has been too much influenced by guesswork and political expediency. The fact that the ducks have made any come-back from the terrible lows of the early 1930s has been due more to luck and the weather than good management.

Now is the golden opportunity to discover what a closed season will accomplish. Now is the chance to evaluate what real benefits may be derived from the great system of refuges that has been created in recent years. With powder and lead now vitally needed by our armed forces; with automobile tires as precious as rubies; with gasoline rationing already in effect, what better time could there be for ducks to have a year's vacation from the gun?

Against such a proposal there will be arrayed the old pleas and pressures that balked a closed season when "Ding" Darling declared that if we did the best thing for the ducks we would stop shooting them. It will be pointed out that revenue from the duck stamp and from the arms and ammunition tax will be lost. It will be emphasized that the state game commissions will lose income from the sale of licenses.

What of it? Fewer automobiles on the road are going to cut the revenue from gasoline sales and motor vehicle registrations. Other war-time dislocations will upset other sources of revenue. The situation will have to be met from general taxation and there is no reason why the conservation commissions and fish and game commissions should not be so supported. That is how they should be maintained anyway.

Certainly no American can doubt that we are in for a period of sacrifice along many lines. We must do without many things that we had come to regard as essential to our happiness. Surely duck hunters can give up killing for a year, particularly when such forbearance will aid the victory we seek and assure the increase of a national resource in wildlife. Let's shoot no ducks in 1942.

Conservation Comment

Conservation by the People is the title of Publication No. 85 of the Emergency Conservation Committee, 734 Lexington Avenue, New York City. It is a report by Mrs. C. N. Edge, Chairman of the Committee, on certain conservation issues that should concern every sincere conservationist. She reports on the successful fight to protect the trumpeter swan, no small part of which was an educational campaign financed by the Committee in Idaho. This should be extended this year, and funds are needed. Mrs. Edge also points out that the wildlife poisoners have been able to get a generous appropriation despite the war; that conservationists should rally to defeat the bill seeking to legalize the slaughter of deer on the Seminole Indian Reservation, Florida; that logging is going forward at such a pace in the Porcupine Forest of northern Michigan that unless bills pending to acquire this area are passed promptly it will be too late. Another threat is to Cook Forest in western Pennsylvania, a primeval forest set aside by legislative appropriation, supplemented by public subscription and the nickels and dimes of school children. This forest is now threatened by a questionable power development that is not approved by the National Power Policy Committee for defense purposes. Mrs. Edge has pointed words to say about the progressive ruin of Whiteface in the Adirondacks and about the plumage battle. Both discussions are enlightening.

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Two bills pending in Congress—the McNary Bill, S.1712, and the Wallgren Bill, S.1915—would widely extend regulatory powers over fishing in offshore waters. This extension is made possible by the decision of the Supreme Court in the Skiriotes case, which affirmed the principle of the power of the Government over its own citizens and vessels on the high seas. This is nothing particularly new, but its application to offshore fisheries is new as well as needed. Whether these pending bills offer the solution or not, certainly immediate action should be taken to safeguard these fisheries resources. Since international agreement is not now practicable, national action should be taken.

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Preservation of imperiled redwood forests in northwestern California before it is too late is urged by the Save-the-Redwoods League in its annual report. Specifically, the immediate task is to acquire the famed Avenue of the Giants in Humboldt County north of Dyerville. It is directly in the path of lumber operations. The State of California will match, dollar for dollar, private contributions made to complete this project. In this connection the words of John C. Merriam, President of the League, are pertinent when he says: "In these days when the world is ridden with hate and distress, mankind needs more than ever the healing value of contact with Nature in its sublimest forms, as exemplified by these redwood forests." Copies of this annual report are available from the League, 250 Administration Building, University of California, Berkeley, California.

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One hundred and forty-five million trees were planted on 151,337 acres of National Forest land during the calendar year of 1941, according to the report of the United States Forest Service. The trees came from the Service's nurseries, and the cost of planting averaged less than twelve dollars an acre. The heaviest plantings were in the Lake States and the South.

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Now ratified by seven countries, the Inter-American Treaty on Nature Protection and Wildlife Preservation becomes effective on May 1, 1942. In order the seven ratifying countries are the United States of America, Guatemala, Venezuela, El Salvador, Haiti, the Dominican Republic, and Peru. The original convention was signed by eleven other countries when it was adopted in Washington on October 12, 1940. It now remains for ratifying countries to enact enabling legislation and issue executive orders or decrees to implement the treaty and carry its purposes into effect.

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As this issue goes to press the United States Fish and Wildlife Service and the National Park Service are packing preparatory to moving to Chicago to make space for the swelling personnel of war agencies of the Government. We still regard the moving of these services, which in number of individuals and use of office space aggregate only a tiny percentage of our present bureaucracy, as unnecessary. Both are intimately concerned with natural resources and with land, both of which are involved in the war effort. However, the Bureau of the Budget marked them for transfer and could not back down and "save face". The relocation is, we trust, temporary.

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Continuation of the increase in the numbers of wildlife in Jasper National Park, Canada, North America's largest wildlife sanctuary, is reported by the Dominion's Department of Mines and Resources. There has been a marked increase in elk, and Rocky Mountain sheep and mountain goats, deer, and caribou are plentiful. Beavers are increasing in all sections of the Park. Bird life is also reported as plentiful, including numbers of waterfowl.

U. S. D. A. PHOTOGRAPH BY HUNTON

"IN TIMES OF DEPRESSION OR INFLATION, THERE IS AN INEVITABLE SURGE TOWARD THE OPEN COUNTRY."

In days of uncertainty and peril many city people think of going

Back to the Land

Garden Editor, Nature Magazine

By ANDREW S. WING

THE IDEA of living on the land has a strong appeal for many Americans. Many of us were farm-born, and few indeed are those who do not have farm blood in their veins—or at least an uncle who was a farmer.

In times of depression or inflation, there is an inevitable surge toward the open country. While the trend today is from the farm to training camp and defense industries, there are still those who are seeking a farm, or who are considering such a move. What chance has the average city family of finding the home of their dreams; of obtaining from a farm a good living and perhaps a bit of income now and then? Is it all a dream or within the realm of possibility for them to settle on a non-commercial farm in the country and fare better on less income than in the city? What are some of the things to consider and the pitfalls to avoid in seeking such a rustic haven?

Every so often a book comes out on some such theme as "Five Acres and Liberty", and there has even been a magazine called "Three Acres and Security". The independent, idyllic life of the farmer has been sung so often that it has become almost an axiom. True, the farmer *is* independent in that he is his own boss, but only a farmer knows the price he pays in hard work and in worry about weather and markets, insects and diseases, for that much-vaunted independence. The farmer does know, and many of them choose to pay that price, else there would not be more than six million farmers living on the land. But the urbanite gazing at the green pastures of the countryman is too likely to be blinded to the disadvantages, while

he sees through rosiest lenses all the glamorous side of country life.

Living in the country is quite a different thing from trying to make a living from the growing of crops and the feeding of domestic animals. I have said for years that if I could make money on the farm as easily as I can in town (not that it is easy anywhere these days), I would start farming tomorrow. For even though I was farm-reared and graduated from an agricultural college, I have no illusions about being able to pick up the habits of farm work and thought that I abandoned twenty-five years ago, to work at a desk. And yet all these years I have definitely hoped and planned to spend my riper years on a farm of my own. My idea, however, is not to farm for a profit but to get as much of a living as I can from the land, to live a more wholesome and a simpler life, and to supplement a modest income from investments and non-farming activities with what the farm will yield. To put it another way, to make a moderate income go further by living in the open country.

U. S. D. A. PHOTOGRAPH BY FORSYTHE

"... TO MAKE MY FARM PRODUCE FOR ME AT LEAST VEGETABLES, APPLES AND SMALL FRUITS ..."

It is easier to make a farm supply one with a fairish living than it is to take a profit from it. It takes wise planning, careful management and judicious spending to adjust a city-bred family to a rural economy. Plenty of folks have gone broke trying to farm, never forget that.

What kind of a farm to buy? That is the first and most vital consideration. In order to simplify the problem, we will eliminate all places that are primarily scenery —land that cannot possibly be profitably cultivated. I once owned such a place up in New Hampshire. The view was grand; the surroundings truly rural; but the five acres were not sufficient to grow anything worth while; the house was untenantable in winter; and was 300 miles from New York where I make my living. We finally let it go, since it just was not a practical place for our family to use.

One of my oldest and best friends has the same longing that I have to live on the land—at least part of the year. We have tramped fields and woods together and bumped over many an "unimproved" road in the search of farms that we could own jointly or near one another. We agree perfectly as to the general region in which we would like to locate, the distance from New York, and even as to the approximate number of acres and amount of money we are willing to invest. But there the agreement ends. Why? Well, you see my friend is looking for a trout farm. He insists on a brook or a pond, or at least a site which could be turned into an artificial lake. In short he wants a retreat—a sportsman's paradise where he can spend his mellower years pursuing the elusive trout.

I, on the other hand, insist on at least twenty-five acres of tillable land, the balance to be mostly pasture with perhaps ten acres of woodlot. My main crop might be "words", but I also would like to have a small orchard, and a nursery in which to grow some of the rarer evergreens, shrubs and perennial plants, and, if the acreage is sufficient, a small herd of black Angus cattle. There should, of course, be a vegetable garden, and a few chickens and a cow (or a milk goat) in case it proved to be cheaper to produce our own eggs, poultry and milk than to buy them from a neighbor. In short I plan to make my farm produce for me at least vegetables, apples and small fruits, fire wood, and perhaps some meat to eat and to sell. The nursery stock would be listed, and sold mostly in a small local way.

It is my hope that other kindred spirits will live within easy walking distance, in case we still have a rubber shortage. Other possible money crops might be holly, Christmas wreaths, maple syrup and sugar, all depending on the way things developed. If I cannot get my rent free, plus taxes, a good living and in some years maybe a little profit out of such a proposition, I think I'll be a pretty poor manager.

In other words I would have a storm cellar—a hedge against hard times, inflation and old-age. Is that not what we all want? Money can come and go—stocks and bonds may vanish into thin air and even life insurance might conceivably become valueless in case of a complete financial collapse or victory by the Axis. But land will always be good, if it is cared for, and a well-built farmhouse is likely to stand for more years than most of us will endure. There is something fundamentally strong about the earth that gives courage and assurance to all that know it—something basic that appeals to most people regardless of whether they have ever lived in the country. But the earth can be cruel, too, never forget that. Many a man has wrecked his life battling against the soil and the elements.

So choose wisely the farm on which to spend what

U. S. D. A. PHOTOGRAPH BY HUNTON

"IS THE EXTERIOR AND INTERIOR ARCHITECTURE PLEASING ENOUGH SO THAT YOU CAN LIVE IN IT WITHOUT TOO MUCH REMODELING?"

should be the happiest days of your life. Of course, if you only want a summer home or a weekend place, the kind of land makes less difference. But we are talking about a place to live the year 'round, and which is to contribute toward the family living. It has been proved countless times that it is poor economy to buy an impoverished farm with the intention of building it up into a moderate state of fertility. By the same token, it is often cheaper to buy a house that has been kept in good repair than to try to make over a tumbledown shack. There are exceptions to this rule, no doubt, but the rule still holds good.

Here are a few things to look for when you shop around for a farm:

1. Is it a good neighborhood with fairly easy access to stores, schools, churches, railroads, highways and bus lines? Also, what about markets for what you plan to produce?

2. Is there enough fertile land, or land that can easily be restored, to produce what you plan to grow?

3. Is the house the right size, and sound, requiring no major operations to make it habitable? Is the exterior and interior architecture pleasing enough so that you can live in it without too much remodeling? What about the water supply, heating and plumbing systems?

4. Are the barns and other outbuildings adequate for your needs without too much repairing or remodeling? Too many buildings with too much roof surface to keep up may be worse than not enough.

5. Last and most important, is it the kind of place that you could learn to love and that you could call home? Does it suggest happiness and beauty of living or is it just an old farm house?

Some of these points you can easily check yourself in company, of course, with the members of your family. Other points will require the aid of an expert, or at least someone familiar with the place and its local reputation.

A county agriculture agent can be found in almost every farming county, and since he is a government agent his advice is impartial and can be relied on. When it comes to the buildings, the services of an architect or good local builder may be necessary in order to determine accurately what condition the structures are in from sills to rafters, and to estimate what repairs and remodeling will cost.

Why does the owner wish to sell? is a good question to ask. If it is a real farm bargain why hasn't some local farmer snapped it up? After you have made it over to conform with your ideas of country living will it be a property that you could dispose of at cost or with only a small loss? All of these questions and many more should be answered definitely before making a commitment.

How much should it take to buy a small family-size farm on which to live, not a commercial farm but one on which at least a part of the living could be made?

That is not an easy question to answer as it depends so much on the location—whether it is near a big city or in a region that gives it suburban or summer-resort value. As little as $2000 might do the trick in some regions, whereas in the desirable areas near New York, Boston or Philadelphia, it would probably take from $5000 to $10,000 and you wouldn't be getting an architectural museum piece at that price either. Nor would you be buying the best-producing piece of ground in the county. But it should be possible to pick up something in that range which would do if you were (Continued on page 271)

A FEROCIOUS-LOOKING RESIDENT OF THE PHILIPPINES

Although wild and temperamental, this little tarsier is a quite tiny relative of the apes and monkeys, found only in the islands of the Malayan and Indian Archipelago and on Mindanao

A very ancient and little known relative of man is—

Amog of Mindanao

Photographs by J. E. Eckman

By M. F. ASHLEY MONTAGU

THE TARSIERS, so-called because of their elongated tarsal foot bones, are among the least known of all the Primates, the Order of mammals to which man, in common with the apes, monkeys and lemurs, belongs. Owing to their great delicacy they are unable to withstand the risks involved in the physical adventure of a change from their native habitat, unless the most careful precautions are observed. This is why they are never seen in zoological gardens.

Early in 1939, however, a pair of tarsiers were successfully transported from the Philippines to the United States. These are now very happily being reared by Professor J. F. Fulton at Yale, under whose supervision a variety of studies of these most interesting little creatures are being made. J. E. Eckman, who collected these animals, also collected several specimens for anatomical study by the writer. And since Mr. Eckman had some of these little animals as pets in his house on the island of Mindanao, in the Surigao Province of the Philippines, I asked him to supply me with such notes upon their behavior as he could. All of Mr. Eckman's photographs of tarsiers reproduced here are of the species inhabiting the island of Mindanao.

The tarsiers have an interesting geographical distribution, being found only in the islands of the Malayan and Indian Archipelago that have recently become household

THREE DIFFERENT POSES OF THE TARSIER

Their eyes are very prominent and natives hunting them in the jungle use lights, which are reflected by the orbs and make the capture of the animals easier. They are nocturnal and, when approached, disappear with amazing speed. Note the toes of the animal pictured below. These bear suction cups on the ends of the "fingers," which are long and are capable of grasping firmly the limbs of jungle trees

words throughout the world—Sumatra, Java, Bangka, Billiton, Borneo, Celebes, Salayer, Sanghir, and Bohol, and Mindanao in the Philippines. In North America and western Europe the tarsiers are represented by fossil forms only, and these are all Eocene in origin. These forms are grouped in a common family, the *Anaptomorphidae*. The modern tarsiers are generally regarded as a group that have survived into the present from Eocene times with but little, if any, modification. They have thus aptly been termed "living fossils."

Professor Wood Jones has for many years claimed that *Tarsius* actually represents the primitive stock that gave rise to the monkeys and apes on the one hand, and to man on the other, but the weight of the evidence seems to be against this theory.

There can, however, be no doubt that the little tarsier represents a very distant and a very ancient relative of man.

Mr. Eckman, a miner by occupation, first caught sight of a tarsier while on one of his picture-hunting expeditions. He was immediately fascinated by this little animal. Sometimes he saw several together, but upon his approach they would disappear with amazing speed, making the most incredibly long leaps for so tiny an animal. He soon discovered that they measured no more than four to five inches from the top of head to rump, and weigh only seven to sixteen ounces when full grown. The natives considered the *Amog*, as they call the tarsier, an exceedingly rare creature.

Wishing to obtain a live specimen, Mr. Eckman offered a reward for

the capture of a live tarsier, and in a period of two years he was able to obtain only fourteen specimens. Most of these specimens died within three days to three weeks after being placed in captivity. Some of these were hurt while being captured; others injured themselves leaping against the sides of the cage, or by fighting among themselves. Among these fighting animals Mr. Eckman thinks that he may have had two distinct species. It was eventually necessary for him to separate the animals from one another, for they rarely survived the ferocious attacks of their assailants. On one occasion, he reports, two females attacked a large male, and made very short work of that poor unprotected creature, almost tearing him limb from limb. They can apparently be vicious little animals, with teeth like needles, with which they hang on tenaciously once they get a good hold.

Tarsius is entirely nocturnal or crepuscular, sleeping by day in the dark hollow of trees, or under large rocks sheltering them from the heavy tropical rains, and coming out only at night in search of food and water. In order to capture them the natives would set out at dusk taking nets very like our butterfly-nets, and large flashlights; the flashlights are used to catch the reflections from their enormous eyes, which helps considerably in discovering their hiding places.

Mr. Eckman found the tarsiers to be highly nervous and temperamental. The noises they made were very similar to the twittering of small birds, but as a rule, he found them to be pretty quiet, retiring to their perches or nests only at feeding time. They quarreled over their food much like kittens, being greedy and consuming more than a third of their own weight in food every day. At first considerable difficulty was experienced with their feeding, practically everything being tried, until it was discovered that live food was preferred, consisting principally of small house lizards, frogs, insects, and the like. Their manner of eating was by grasping the victim in their hands and attacking the head first. On one occasion, out of curiosity, Mr. Eckman placed quite a large frog, almost the size of themselves, in a cage with two tarsiers. They attacked it ferociously and finally killed it, but they would not eat it.

It is a common belief among the natives that tarsiers eat charcoal. Mr. Eckman always kept a quantity of charcoal available in their cages, and he believes that they actually consumed some of it, although he does not appear to have observed the actual process.

Tarsiers seem to drink surprisingly little. Of their other habits, Mr. Eckman remarks that they keep themselves remarkably clean, and wash their faces like a cat; and he adds, "They are very hard to tame, and never become accustomed to handling." Amog and General MacArthur, in this regard, seem to have a great deal in common.

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A TIME ★ ★ FOR ACTION

We stand for the continuance of every worthwhile national activity consistent with winning the war in the least possible time—the war to preserve the American way of living. We have expected over-zealous proposals that would jeopardize rather than advance national security. We have been preparing ourselves for an earnest opposition to such measures. Such a one now confronts us.

On March 24 an appropriations committee presented to the House of Representatives its report on a bill to finance the Department of the Interior during the coming year, and did so with a commendation to that Department for its voluntary reductions in expenditures. On March 27, the committee having made even further reductions, the Committee of the Whole House on the State of the Union, with only one hundred members voting, eliminated one of the basic activities of the Fish and Wildlife Service.

Sixty-one Congressmen thus succeeded—for the time being—in wiping out completely all appropriations for "investigating the food habits and economic value of North American birds and animals in relation to agriculture, horticulture, and forestry, including methods of conserving beneficial and controlling injurious birds and animals." Sixty-one Congressmen gave walking papers to a staff of naturalists so specialized that they cannot so well serve the nation in other fields; naturalists whose work is of basic economic importance to the country, whose materials and collections are invaluable, whose service as watchmen over those who would destroy beneficial wildlife in control campaigns merits the continued support of all conservationists. And the sixty-one Congressmen did this in response to an amendment offered by a gentleman who declared, "I wonder if the Department is trying to find out who killed Cock Robin, or if it is endeavoring to ascertain how much wood would a woodchuck chuck if a woodchuck could chuck wood."

The House of Representatives further undermined the work done by the Fish and Wildlife Service through bird and mammal investigations and fisheries research by cutting these appropriations in half.

Fortunately, not all the Members of Congress are so flippant as to wonder whether these naturalists are trying to find out who killed Cock Robin. Congressman Jed Johnson, of Oklahoma, for example, during the course of the March 27 debate, declared that the Fish and Wildlife Service "is one of the most popular services in the United States, and if he thinks the people of the country are not behind it he is mistaken." Fortunately, also, this bill must still be acted upon by the United States Senate, and before it has come before that body, there should be in the hands of every Senator ample evidence from their constituents interested in conservation that these items should be restored.

Conservationists are willing and eager to make sacrifices for victory, but they are not willing to approve the needless destruction of those things that should be safeguarded and for which we fight. They want their sacrifices to be effective—not futile.

They should tell this to their Senators, immediately.

THE MOTHER BIRD PUTS ON HER "WOUNDED" ACT

Like the killdeer she dragged her wing as though it were broken, and once she flew into the base of a clump of wild grasses with both wings outstretched, as though mortally wounded

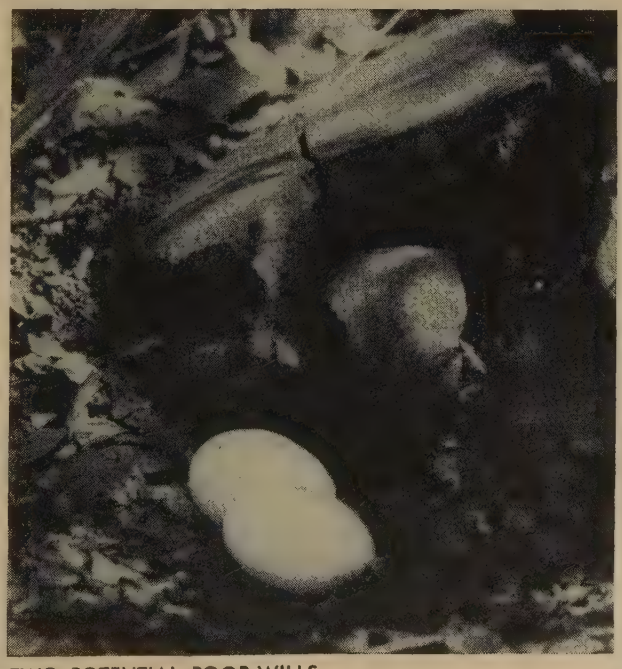
Phantoms of the Dusk

Photographs by the Author

By LEWIS and MARIAN WALKER

"I'VE FOUND IT!" Startled and elated, I realized that the nest for which we had been fruitlessly searching for nearly an hour was within eighteen inches of my foot. The incubating bird was "frozen" in position, absolutely motionless. I had almost stepped upon her, yet she did not disclose the secret beneath her until I practically touched her back with my hand.

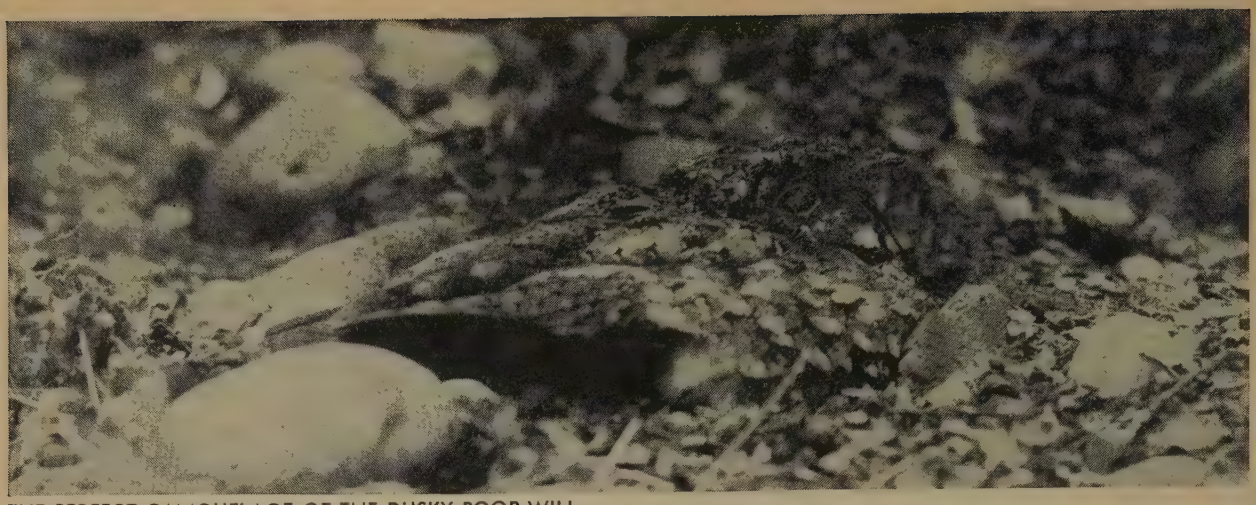
A botanist friend had found the nest quite by accident the previous day. He was breaking the bloom stalk of a wild snapdragon when a motion of the bird drew his attention. Less than six inches from his hand was the nest with its two dull white eggs. Knowing our desire for data on the nesting of the rare and extremely elusive dusky poor-will, he gave us detailed directions. We felt sure we could go direct to the site, but only after diligent search for nearly an hour, passing many times within three feet of the incubating bird, were we successful.



TWO POTENTIAL POOR-WILLS

Left uncovered, the eggs quickly attracted the attention to the nesting site of the bird

There on a gentle slope of the historic San Diego River Valley, where many years ago the brown-frocked padres trod, lay the nest of a dusky poor-will, *Phalaenoptilus nuttallii californicus*. It was cradled in a slight depression in the soil under the abutting protec-



THE PERFECT CAMOUFLAGE OF THE DUSKY POOR-WILL

It was only some small movement of the bird that would attract attention even though the searcher for the nest were only a few inches from the site

tion of a granite rock and shadowed by a large toyon bush, which gave light and shade in a checkered effect. The nest was situated in an area recently ravaged by a fire that cleaned the dry growth from the ground but left most of the brush intact. The burned ground area was a mottled, dark brown, speckled with the dry, white ash of toyon leaves. The brown of the poor-will's plumage was the same shade as the surrounding earth, and the mottled white markings on the body were like the specks of ash that covered the area, thus giving the effect of a body entirely without outline. This was further enhanced by the quivering spots of sunlight streaming through the toyon branches as the wind gently stirred the leaves. The entire picture was one of dancing light and shadow. Defensively speaking, the nest was perfectly located. It was bordered on the sharp incline to the rear by large boulders and scrub oaks, while to the front and each side the incubating bird had unimpaired vision at all times.

There was no attempt at nest building. The birds merely select a site offering the best protection for the eggs, and scoop a slight depression in the earth. As in so many instances, the conspicuous eggs emphasized the generality that the greater the protective coloration of the parents, the less the need of protective markings for the eggs. The uncovered nest with its two treasures, resembling lusterless white stones, could not have been overlooked, even by an unobservant person. With the parent incubating, however, it would be practically impossible to locate, particularly in view of the singularly fearless attitude of the female and her unwillingness to leave.

Thirty minutes after she had flushed the parent bird returned with a moth-like, noiseless flight, landing a few inches from her eggs. With a sidewise, settling motion, she became merged into her surroundings like a drop of ink on a black blotter! Not until the crackling of a dry branch disturbed her did she again leave the nest. Our conversation in moderate voice seemed to have no effect upon her. Observations during the next few days indicated that only natural sounds, such as crackling twigs and the calls of various birds, caused alarm. For the first three days of our studies, we were able to come very close to the nest before she gave any indication of seeing us. However, she became increasingly nervous as each day passed with its photographic disturbance.

THE EGGS HAD HATCHED

After the mother had left the nest the two chicks cheeped, seemingly to each other

On our first visit she left the nest with a distinct hiss and wildly-beating wings, flying to a clump of sage about fifteen feet away. As we approached, she fluttered on the ground simulating a broken wing in much the same manner as the familiar killdeer. This was repeated as we followed for photographs, and once she flew into the base of a clump of wild grasses with both wings outstretched as though mortally wounded. We finally lost her in the thick growth of the scrub oak, but could hear her solicitous and anxious "werk, werk" call at intervals, even though she was not visible. Flushing her from the nest in the early dawn and evening, how-

ever, produced the plaintive "poor-will-o, poor-will-o" call, which is so eerie as to be indefinable. This was often answered by the male from a nearby hillside, although we failed to sight him on any of our visits.

During incubation, the female sat upon the nest in drowsy fashion, with wings held loosely over the sides, and the eyes closed until they were mere slits. The feathers on the body were partially roused. This disheveled appearance lent additional protection, as the entire body resembled a small patch of dried, wind-blown leaves, providing an excellent camouflage.

Noon of the second day found a downy baby about the size of a newly-hatched quail, and exactly the color of a dried apricot, out of the shell. The second egg was pipped. This hatched late the third day. When we arrived there were two bright-eyed youngsters, dry and fluffy, peeping out at us from beneath the mother. At our approach, the female reared back to a sitting position and gave a long series of guttural hisses from her wide-open, cavernous mouth with its soft pink lining. As we drew nearer, she gave a despairing cry and flew off, again giving a perfect imitation of a wounded bird, in one last effort to divert our attention from the nest. She then froze into position under a clump of toyon on the hillside and sent forth her mellow "werk" calls, which grew less frequent as we continued with our work.

After the mother left the nest, the young constantly uttered a plaintive "cheep, cheep", seemingly answering each other. We had noticed this same reaction after the first bird hatched. Each time it cheeped there would be a muted echo from the other chick still within the shell.

We found the young amazingly agile. The first-born, frightened at our presence, left the nest, taking short, frog-like hops of about eight inches in length, seeking cover under some dead brush. We watched carefully for the next two days, marveling at the intrepid courage of the mother and the increasing agility of the chicks. Then came the time when a deserted nesting site greeted us. No amount of searching revealed the whereabouts of this little family, and like many another unexpected thrill they became a pleasant memory. Were they still alive? Later when this romantic valley of the padres called us back, still searching, we heard in the distance again that wonderfully eerie, melodious "poor-will-o, poor-will-o". First from one side of the valley it came, and then from the other; and then again in the protection of the deep dusk above our heads, as they floated on the wing like giant brown moths, in search of their nightly insect food.

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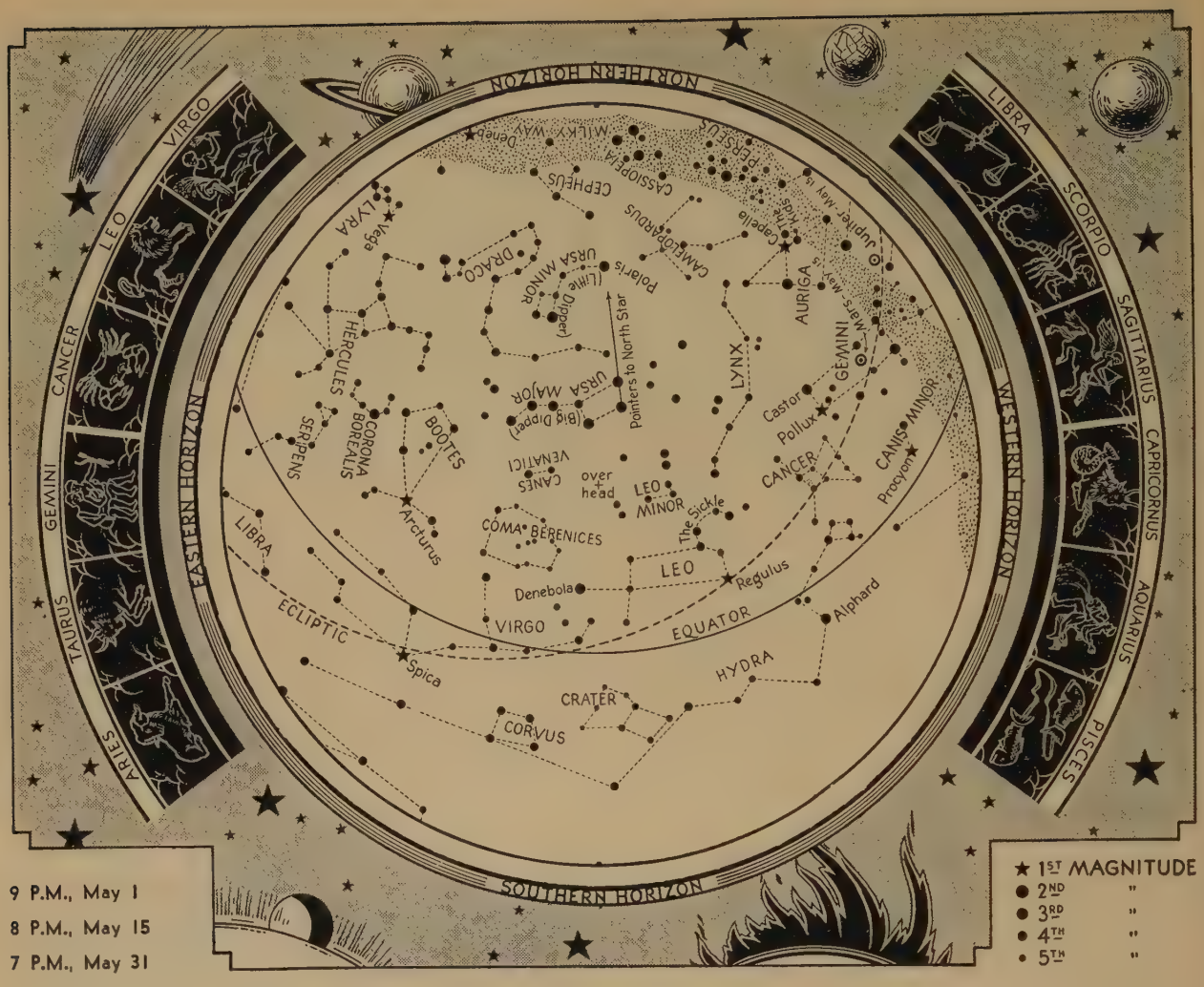
Mountain Spray

By JOHN LINDSEY BLACKFORD

SHOWERING creamy-white panicles of showy bloom, mountain spray drapes the lower slopes of the Rockies in June. Dry woods and open hillsides are rejuvenated by its snowy blossoming. In favored spots, rocky canyon walls fairly cascade its falls of floral foam. All this beauty, created by minute, faintly-fragrant flowers hung in large pyramidal clusters, lasts a long time.

Wild goat's beard, as the bloom is also called, is borne upon slender, erect stems, three to eight feet in height. Leaves of the shrub are silky, strongly-veined, and light-colored underneath. Several varieties, including *Sericotheca discolor* and *S. dumosa,* occur in the West. The plant is a member of the rose family, and is characteristic of the thinner woods common to the montane zone. False meadowsweet is still another name.

The lovely masses of mountain spray pouring white down rugged hillsides is but one of several wholesale blossomings that wreathe the western spring and summer with extravagant bloom. In May both Pacific dune and inland slope are spread with the glory of rhododendrons. From early May through June Oregon's westward-flowing streams and valleys are fragrant with azalea, creamy white and touched with pink and yellow. Southward in June, blue blossom or California myrtle, *Ceanothus thyrsiflorus,* flaunts its color along the coast range. From April into summer Scotch broom blazes amazing gold along our central and northern coasts, but its very boldness reminds us that it is an interloper. We are likely to remember longer dogwood's shy delicacy, coming in early summer and again in fall. But not the least is the unsparing display of the goat's beard, whose creamy-white delicacy is charming.



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

The Celestial Sphere

By ISABEL M. LEWIS

IF ONE wishes to locate a place accurately on the surface of the earth it is necessary to know its latitude, which means its distance north or south of the equator—that great circle of the earth sphere which passes midway between its north and south poles—and its longitude, the distance east or west of another great circle, the zero meridian, which passes through the north and south poles of the earth and some chosen place such as Greenwich, England. Every place, of course, has its own meridian, which is the great circle that passes through that spot and the north and south poles of the earth. Its latitude will be its distance north or south of the equator measured in arc along this meridian, and its longitude will be its distance east or west of the meridian of Greenwich measured along the equator to the point were the meridian of the location crosses the equator, also expressed in arc. Longitude, however, may be expressed in hours, minutes and seconds instead of degrees, one hour equalling fifteen degrees of longitude. So, for example, we may say that Washington, D. C., is in 38 degrees 55 minutes north latitude, and in 77 degrees 4 minutes west longitude, meaning west of Greenwich. It might also be said that Washington was 5 hours 8 minutes west of Greenwich, which is the equivalent of 77 degrees 8 minutes in time. This serves not only to locate Washington, D. C., but also, because of the degree of accuracy given, the position of the Naval Observatory in Washington.

Let us now consider another sphere, the center of which lies at the center of the earth. It has a radius so great that it extends beyond the most distant objects in the heavens and we see these celestial objects all projected upon the surface of this enormous sphere, which is concave toward us, or has the appearance of a great dome arched above our heads because we are at its center. This is what is known as the celestial sphere, not actually existent, but a most convenient and important device that makes it possi-

ble for us to locate an object in the heavens by means of its right ascension and declination just as we can locate a point on the earth sphere by means of its longitude and latitude.

Declination on the celestial sphere corresponds to latitude on the earth, and when we say a celestial object is in 20 degress north declination we mean that it is 20 degrees north of the celestial equator and that as it crosses the meridian of a place in that latitude it will pass directly overhead, or through the zenith. For example, when the sun is in 20 degrees north latitude, as it is near midsummer in the northern hemisphere, it will pass directly overhead when it crosses the meridian at all places in 20 degrees north latitude. Vega, that beautiful first-magnitude star of the northern hemisphere, now rising in the northeast in the evening, has a declination of about 39 degrees north, so when it crosses the meridian of Washington, which is in 39 degrees north latitude, it will pass directly through the zenith.

Right ascension on the celestial sphere corresponds to longitude on the earth. As in the case of longitude it can be expressed in time or in arc with this difference, that while longitude on the earth is counted up to 180 degrees, or 12 hours, east or west of Greenwich, right ascension is counted from 0 degree, or 0 hour, through 360 degrees, or 24 hours. It is counted from a great circle of the celestial sphere that passes through the vernal equinox, which is an important point of reference on the celestial sphere, and may be measured either along the celestial equator or a small circle through the star parallel to the equator, just as longitude on the earth can be measured either along the equator or along a parallel of latitude passing through the place. Right ascension is always measured in a eastward direction; so of two stars above the horizon the star that is farther east will have the greater right ascension. One may think of the celestial sphere as crossed from north to south by great circles that pass through its north and south poles and the zenith of the place, analagous to meridians on the earth's sphere. These great circles are called hour circles. A very important quantity in navigation is the hour angle of a star, which is the angle at the pole of the celestial sphere between the meridian and the hour circle which passes through the star. Another way of looking at the right ascension of the star is to think of it as the angle between the hour circle passing through the vernal equinox and the hour circle passing through the star measured in west to east direction.

When the right ascension and declination of the star are known it is a simple matter to locate it on a star atlas, which shows the positions of the stars plotted by means of their right ascensions and declinations. Just as on an atlas of the earth it is a simple matter to find a place when we know its longitude east or west of Greenwich and its latitude.

A very important matter astronomically is the determination of time. The right ascension of a star when it is on the meridian gives the star time, or sidereal time, as it is called. So, knowing the right ascensions of the stars, if one records the time when they cross the meridian one has directly the sidereal time. A simple calculation then gives the corresponding mean time, or ordinary clock time. The difference in time between two places gives their difference in longitude. So if a navigator carries a clock showing Greenwich time, and finds from observations of the stars his local time, which can be done in a number of ways, the difference of the two gives his longitude. From observations of identified stars, making use of their declinations and the time of the observation he can also find his latitude. His exact position on the earth, then, is obtained from knowing the positions of the stars on the celestial sphere, and their positions with respect to his meridian at the time he makes his observation.

The celestial sphere has in addition to its equator, and the poles which lie directly above those of the earth, another important great circle known as the ecliptic. This intersects the celestial equator in the vernal equinox, from which right ascensions are counted, and also in the autumnal equinox, 180 degrees distant from the vernal equinox. The sun is at the vernal equinox when spring begins in the northern hemisphere, and at the autumnal equinox when autumn begins in the northern hemisphere, or spring in the southern hemisphere. The ecliptic is the great circle that marks the path of the earth in its orbit around the sun as seen projected on the celestial sphere, or the apparent path of the sun through the heavens in the course of the year. It lies in the center of the path of the Zodiac, which extends eight degrees to either side of it. Within this belt of the Zodiac, which can be easily traced by means of the twelve well-known constellations through which it passes, will be found the sun, moon and planets.

Such are the chief features of the celestial sphere, with which one must become acquainted if he is to navigate by the stars, or identify them readily on star atlases by their cataloged positions. It is surprising how quickly this knowledge can be attained with just a little observation of the stars and identification of them with the aid of maps from night to night.

This month will be the best time for this year to observe the planet Mercury in the evening sky because it will be at greatest elongation east of the sun on May 18. It will set about one and a half hours after the sun on that date in the northwestern sky and will be about 19 degrees above the horizon at sunset. One should be able to see it for a week or more before and after that date. Venus is still a conspicious object in the morning sky before sunrise. Mars now appears not much brighter than a red star of second magnitude in the western evening sky. It is in Gemini, setting about four hours after the sun. Jupiter is still visible in the west but is rapidly approaching the sun. It is in Taurus. Saturn will be in conjunction with the sun on May 23 and cannot be seen this month.

MEMORIAL POEMS

Again we are pleased to cooperate with the Chattanooga Writer's Club by publishing the three prize-winning poems in the Elberta Clark Walker Memorial Nature Poetry Contest established in 1925 by Robert Sparks Walker in memory of his wife. Helen Catherine Robinson, winner of first prize, comes from Falls Church, Virginia; Kate Rennie Archer, second prize winner, from San Francisco; Elma Dean, winner of the third prize, from Oakland, California.

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INDIAN SUMMER

By HELEN CATHERINE ROBINSON

Now in the moon of the falling leaf—
The feathery goose-summer of the year—
When aeronaut spiders engineer
Their gossamer to snare a thief;
When pelage of the rusty deer
Turns gray as the smoky atmosphere,
We turn to legend as to belief:

Squaw Winter flings her sharp attack:
Wind fingers cut like slivered glass,
Small footsteps whisper as they pass;
Then a skiff of snow where a rabbit's track
Gives light to the darkened world of grass;
And night is a witch with claws of brass
And a lump of ice in her gunny-sack.

Old Man shivers, pulls his blanket in,
Then cups the end of a woody reed
And fills it with a new-dried weed,
Crushed in an elk-hide moccasin,
And smokes; while sharpened senses heed
The lack of meat and winter seed.
"I go hunt—go make medicine."

Old Squaw grunts and laces tight
Her bag of tricks for a week or two.
The air is calm and the upper blue,
Save for Old Man's smoky sleight,
Is clear and cloudless, almost new;
The cordial sun gives an interview
Where grace is tantamount to light.

All things are wrapped in a veil of heather.
New-summer gilds with a softer glow
The pallet of the tupelo.
Harsh rocks are soft as a mocker's feather,
Coyote, black-brown buffalo,
Fool-hen, warrior gobbler, crow—
All are color, blended together.

The flesh of deer and giant stag,
Fat-bellied beaver, soft-eyed hare,
Red squirrel from a handmade catgut snare,
Antelope pivoting on a crag,
Young fox pelts from a poisoned lair,
Sacred white buffalo hide—for prayer:
All loot for a parfleche saddle bag.

Ponies are caught and tethered inside,
Maize is stored like virgin gold
In wicopy woven to basket mold.
Apples are baked in the sun and dried,
Peppers are strung on a thong and poled,
Pelts are fashioned to fend the cold.
Old Squaw grunts and is satisfied.

The taboo bear rolls off to its den,
The snake and lizard no longer creep
But coil and huddle in a heap.
Old Man mends the eagle pen
And digs the council chamber deep,
Then crouches down and falls to sleep.
And Indian Summer has gone again.

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NOVEMBER VINEYARD

By KATE RENNIE ARCHER

I had forgotten how autumn could flame
Till the orange of orchards hurt the eyes,
Till color of low vine-leafage,
Apple-crimson, close to the ground,
Could call to the heart like brass music of marches,
Could captivate sight like red tunics of soldiers.

I had forgotten how, still in November,
Grapes could hang dark blue under red leaves,
How, with the polish of rainfalling, foliage
Glimmered to garnet,
To gold and carnelian.

And oh, it had utterly faded from mind
How topaz-light, ruby, emerald, amethyst,
Shone across vineyards following rich white rain,
How the small grass could spring swift in the tree-lanes
Till yellow and scarlet of slow-dying autumn
Blazed out above the first spear-green of springtime.

I had forgotten how, over the shoulders of hills,
Paralleled tree-tops wound in waved ribbons
Till hills bugled rhythms of rising and falling,
Till whole breasts of mountains moved, as my breathing
Rises and falls, to the metre of hill and hollow.
I had forgotten how clamantly color could cry,
That glory could be beyond bearing,
That life's great stern regalities
Do not belong to spring.

•

CROSS-PULL

By ELMA DEAN

Wolf-dog, the fast one, who for many a dawn
Ran godless in a green and godless land,
Now in a high place reads the scented wind
And is disturbed. A strong thing calls him on
Into the fenceless grass—the cool to touch—
Fragrant with feathered and prong-footed ones—
Where always the tantalizing danger runs
With the jewel-eyed, the quickly-out-of-reach.
But a stronger pulls for warmth and given food—
The rough caress of hands, the praising word—
The pleasant touching of the high unfurred—
The good salt taste, the shiver in the hide.

The wolf holds fiercely back . . . the dog heart grieves
And there is whining from the tightened throat.
Remembering the ache for plume and pelt
And the glutted finish in the broken leaves,
Wolf-dog, the fast one, tilts his muzzle high
And howls his answer to the throbbing sky.

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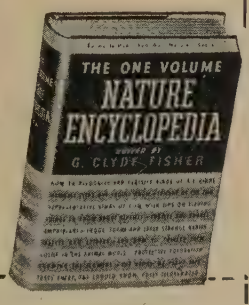

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BACK TO THE LAND

(Continued from page 261)

not too fussy about all of the conveniences.

Often it pays to put a few thousand dollars more into a good place rather than to try to build one up. I have seen many an old house turn into a rathole for money once the remodeling was started. It is fun to do over an old place with fireplaces, wide floor boards, pine panelling, hand-hewn beams and hand-wrought hardware. But they are often in such a bad state of repair that countless hours of labor and thousands of dollars' worth of material must be expended to make them truly liveable. You will want winter comfort, naturally, which means insulation, weather strips and a modern heating plant. Plumbing costs money too, and so do good electric installations. Bear in mind that many materials are unobtainable at this time, and good mechanics are not too plentiful either.

But do not let me discourage you. The trend towards the open country was well started when the war began, and it will probably be accelerated again as soon as there is any rubber in sight. The subsistence farm or homestead is a perfectly sound idea both for those who wish to retire or who want to live on a bit of land and work in town. It is not any millennium. You cannot hope to dash into it willy-nilly and make money right away, or even break even. It just is not in the cards.

Too many city people have tried it and failed. They either move out too far, or invest too large a part of their savings in the house and its conveniences rather than in the land itself, or else they think they can get some one to do all the dirty work for them. If you hire all the work done, you will, unless you are an extremely competent manager, find that your milk and eggs and vegetables are costing you more than if you bought them from a neighbor or the village store.

Last of all, remember that this kind of living must be compatible to every member of the family. All must enjoy it enough to be willing to do their share of the chores and to put up with some of the inconveniences of living several miles from town. If you like people—real farm folks—you will enjoy the friendliness of the farming country. But if you enjoy only the company of sophisticates, better stay close enough to one of the big towns so that you can associate with people who have the urban viewpoint.

Children usually love farm life. Some women do, others do not. Men are often more adaptable to country life than women and like it better. Be sure you are really going to enjoy it before making such an important step.

Campout Training

Plans for a free ten-week évacuée campout training course for adult leaders in the defense, education and recreational fields have been announced by the Buffalo, New York, Museum of Science. The course was originated by Ellsworth Jaeger, assistant curator of education, and will be under his direction. It is predicated on the possibility of mass evacuation from threatened cities and the possible temporary necessity of a large number of people subsisting in the open. In the event of such an emergency leadership will be necessary, particularly because the ability to be self-sufficient and resourceful outdoors is today a part of the equipment of so few people.

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THE SCHOOL PAGE ★★★

EDITED BY DR. E. LAURENCE PALMER

Professor of Rural Education, Cornell University, and Director of Nature Education, The American Nature Association

How Firm a Foundation?

To most of us Americans with an orthodox religious rearing, the title of this article should be in the form of an assertion of conviction rather than in the form of a query or a suggestion of doubt. However, in times of stress weaknesses that may have gone undetected in the past will become obvious, and factors that show strength will be more appreciated than ever.

This article proposes to evaluate efforts in Conservation Education, Nature Education and Science Education in terms of the contributions they are making, should make, or are failing to make, in the present worldwide situation. The comments are directed at no individuals or organizations, but rather at philosophies.

Most sportsmen feel that they are primarily responsible for the maintenance of the game species. Thus many other species have been encouraged or destroyed because of known or assumed influence they may have on the game species. Hunters have advertised widely that game is a crop that should be maintained on the land; a crop capable of bringing appreciable returns to society in the form of flesh, exercise and the development of the "manly" skills associated with killing. In spite of this, when an emergency such as the present arises, many of them meekly say that this is no time to ask for public support of their efforts to maintain an optimum population of the game species. Rather, they say, now is the time to sit tight and prepare for what may happen after the war. Why is such a view necessary, if they were right in the assumptions they have made in the past? Even if all that game species had to offer society was to serve as targets and to supply food, then now, more than any other time, should we not increase our efforts to have them represented in abundance? Isn't it strange that the movie industry, which is reputed by the National Research Council to take in approximately a billion dollars a year through its box offices, is obviously justifying its existence at the present time, while wildlife, estimated to have almost identical financial value by the same body, is being more or less ignored?

The whole philosophy, that wildlife is primarily the property of those who would destroy it, is wrong. Any philosophy based on such a foundation is bound to fail. Now, more than ever before, those interested in the values of living wild things to society should exert themselves for increased recognition. It is true that, under the present circumstances, wildlife projects are not likely to receive much legislative support. This suggests that Conservation Education built on the foundation that wildlife belongs to and should be the concern of a relatively small proportion of our population is wrong. If everyone appreciated the true place of living wild things in our modern society, support of wildlife measures would not lag.

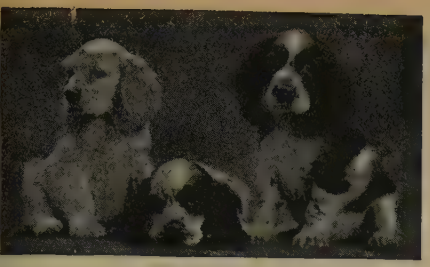
Already, one western state has indicated doubt that its state conservation department should be primarily a sportsman's lobby. Now it wants public support to carry on. This would not be necessary if Conservation Education had been built on a firm and broad foundation—on recognition of both the interests of the Nature lover who would kill nothing, and of the sportsman who would kill to the limit. Increased responsibilities are now being piled on our farmers, and wild species that have much to do with the success or failure of some crops should be managed now more carefully than ever. What has happened these days to all of those game managers who a few years ago made so much of bringing the farmer to their major state and national meetings and there telling him that both sportsmen and farmers had a common interest in wildlife and so should work together? Are the sportsmen letting the farmer down at the very time when he needs the most help? If Conservation Education has failed in the present emergency, it is because it was not being built on a firm foundation.

And now we come to Science Education. The watchword in the forthcoming report of one of the important departments of the National Education Association is that everything given the student should be "functional". A few years ago it was "consumer's science". Again, it was "survey". For a while, it seemed to be the philosophy of some science educators that their offerings must be so serious and dry that it would be against the law to work with a smile or to consider as scientific anything that could possibly be useful. These sobersided science teachers wrote tomes of references to other tomes that were built on other tomes. Without batting an eye, they wrote about and quoted as authentic many things that were absolutely contradictory. Most of them were so engrossed in bibliographies that they lost all the perspective which goes with the exercise of common sense. They would never have recognized as an experience in science the taking of an overnight field trip in winter for the sake of watching what goes on in a beaver colony in a snow storm. There is nothing academic about keeping warm lying still under a snowbank in winter or in keeping perishable foods unspoiled as long as possible on a summer field trip for a few days under your own power. Many of our students trained in the philosophy advocated by many leaders in Science Education in recent years will within the next few months find themselves face to face with maintaining an existence in a strange territory, "living off the land" as do their opponents. They will learn more science, such as some of us have advocated, in a few days in such a laboratory than they learned in years under the aegis of those who based all on the returns of worthless standardized tests. The suggestion that our science offerings be "functional" is not bad unless it is carried to such an extreme that the result is too superficial. The old woodsman who lives by himself, the fisherman who matches his wits against the weather and a wily animal, and other outdoor folk who are forced to use their wits in getting along with Nature have much to give to the science teacher. If we are to have a truly "functional science" in the future, as advocated by some, let's watch to see that it is broadly functional and is able to carry on without resort to the help of any kind of intellectual gymnastics.

A few years ago a school teacher from a rural area wrote asking me which ends cows and horses used first in getting up and in getting down. Since I last wrote for this page, I have had a letter from the president of a rural bank asking the same question and saying the farmers in the region could not agree on that matter. The bank president said in all seriousness that he would accept as authoritative whatever I wrote on the subject. I was tempted to give him the wrong answer so that he would assume that the cows of his region got up in an unorthodox manner—if he ever took the trouble to observe a cow in such an act. But the point is, here was a man apparently so trusted by the people of his community that they turned over their savings to him, and yet his education had taken him so far from the studying of realities that he was unable by his own efforts to get the answer to such a simple question as he asked me. I rather suspect that this inability of individuals to depend upon their own ability to observe, and draw conclusions from what they observe, is more general than we might at first think. If this is so, we again need to build our Science Education, our Nature Education and our General Education on a firmer foundation than has been usual in the past.

In Nature Education, we have erred as we have in Conservation Education and in Science Education. At times, we have emphasized or overemphasized the esthetic. At other times, we have accepted the mere naming of kinds of things as adequate accomplishment. Some have given undue weight to applied Nature Study such as we find in gardening, and some have thought of Nature Study primarily as a recreation. Just as failure to measure up to opportunities of the times has been chalked up against Conservation Education and Science Education, so has Nature Education been found wanting when it has failed to build on a broad, firm foundation. Nature work may have some significance to those with religious inclinations, but the Nature aspect of religion is not the complete religious experience any more than the religious aspect of Nature work completely exhausts the field of Nature work.

We are being told by the radio and by other agencies these days that we must learn to hate; this, in spite of the fact that all of us are willing to make greater sacrifices for those whom we love than for the punishment of those whom we hate. These are times so critical that in all fields of human endeavor we must build on broad, firm foundations, if we are to succeed in our efforts either in the immediate or the distant future. If the sportsmen conservationists do not have faith enough in their own philosophy to defend it as essential in times of emergency like the present, they do not deserve public support at other times. If the academic scientist or the emotional Nature lover cannot prove his worth to others as well as to himself, he should determine now what his weaknesses are and make the necessary adjustments. Let's all examine ourselves these days and develop an abiding faith in what we are doing, to the end that we can continue to serve society.



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THE STORY OF AN INSECT GARDEN

(Continued from page 248)

parish, celebrated in his *Natural History of Selborne,* was only fifty miles from the largest city in the world. My Long Island hillside is hardly half that far from the biggest city in America. Anywhere in the country—on farms, in villages, even in the heart of a metropolis—there are opportunities for exploring in the near-at-home jungles of the insects.

In recent years, an increasing number of gardeners have been setting out berry bushes and nut trees to provide food attractive to birds. Songbirds, flitting from branch to branch and filling the air with their melodies, add to the appeal of any garden. Similarly, the addition of a few butterfly bushes or orange milkweed plants will attract the most beautiful of insect visitors to your yard. Butterflies add color and life, beauty and interest, to a garden-plot. They supplement the songs of birds and the perfume of flowers.

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For Shell Collectors

The second and third issues of *Johnsonia* have come to hand, dealing respectively with the Genus *Ficus* and the Genera *Dosinia, Macrocallista* and *Amiantis.* In our January, 1942, issue we announced this publication designed to be of immense value to all interested in shells both for study and collection. The first issue dealt with the Genus *Strombus.* According to the original plan those interested were to so indicate and be notified of the appearance of each issue and pay for these individually. A wise modification of this plan has been to offer a yearly subscription price of three dollars, which will cover the first hundred pages of *Johnsonia.* This eliminates the need of making small remittances. Yearly subscribers will be sent the issues already published and subsequent issues as they appear. This is a non-profit enterprise of the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts. Six hundred subscribers are needed to make the program pay its way so far as the paper, printing, engraving and mailing costs are concerned. If you are interested in shells, or know anyone who is, do not miss *Johnsonia.* Send subscriptions to the editors of *Johnsonia* at the Museum, or write for further information.

Have Any Skulls?

Thomas G. Nielsen of Baker, Montana, Box 151, is an amateur paleontologist and mammalogist and would like to correspond and exchange specimens with others similarly interested. He would like some mammal skulls and the like for use in his high school biology class.

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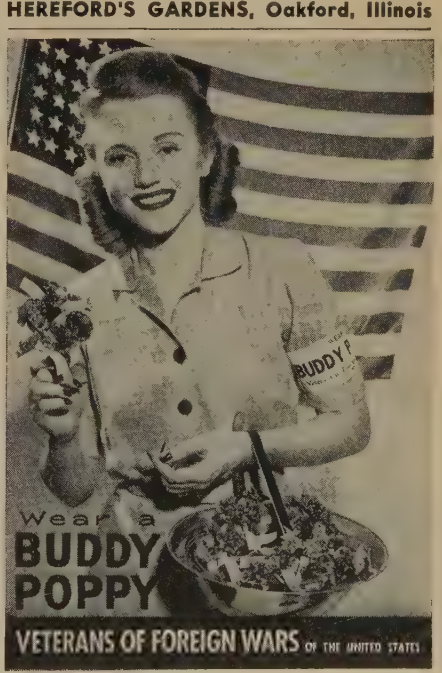

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NATURE IN PRINT

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(Continued from page 231)

breathlessly exciting but always the result of this storm, which traveled a third of the way around the world and at its height covered an area larger than the United States, raining, snowing, and blowing, chiefly upon California. *Storm* ranks high also in the fiction of fact, the author having spent more than two years in collecting meteorological data and checking details with authorities. *Storm* is both exciting and satisfying.

Most highly to be prized, however, by readers who are interested in weather, particularly amateur observers, is William H. Wenstrom's *Weather and the Ocean of Air.* This is the sort of book that Gove Hambidge might have written had he abandoned the editing of the contributions of his experts and instead synthesized their work in a continuous account, though he would have missed the personal experiences of Major Wenstrom, which include among others more than three hundred hours flying at all altitudes between sea level and five miles. This book, aiming to "interpret science," is an interesting history of weather studies, a description of the various aspects of the air ocean, and a discussion of the explanations that men have formulated. It is also a practical guide for amateur weather men and others of us who are going to rely more and more on our own observations if we hope to have forecasts. At the same time it is in many places most pleasantly written.

"People vary in their reactions to thunderstorms," writes Major Wenstrom, for example. "Some few take to feather beds in the fear that Thor will personally seek them out for punishment and destruction (though a feather bed actually avails against a lightning bolt about as effectively as a garden gate stops a railroad train). Other people, perhaps equally foolish, rush to hilltops in the fond faith that Divine Providence will somehow ward any wandering electric bolt away from their exposed heads. Actually a thunderstorm is a beautiful and gigantic experiment in physical science, doubly interesting to those who know something of its causes and its mechanism, wildly beautiful to all men conscious of beauty in Nature."

Let a reader subject himself to the excitement of George Stewart's *Storm,* and follow this up with the pleasant and instructive reading of Major Wenstrom's *Weather and the Ocean of Air,* and he will be a sure prospect for Gove Hambidge's *Climate and Man*—a book of reference reading par excellence. Whether then he has a May day like that described in *The Prime of Life,* or an inclement evening, he will be well stocked with reading. Neither rain nor snow nor sleet nor hail need dismay him.

To Be Healthy

Abundant Health. By Julius Gilbert White. Madison College, Tennessee. Julius Gilbert White Publications. 378 pages. $3.50.

Nutrition is the watchword today. It is the fundamental thought in war garden activities in the world war of 1942. It is of vital importance in the successful conduct of the war and the maintenance of health, both in the armed forces and among the civilian population. It is the author's contention that ninety per cent of disease could be prevented if people knew and observed the laws of life. He subscribes to the saying that many graves are dug with our teeth, and between the covers of this book he has assembled the latest information, which, if followed, he feels would vastly check this fatal human habit. If such a book as this could be carefully studied and followed by housekeepers we would be a happier and healthier nation for it. The author has employed an interesting physical device by numbering each of his paragraphs. This provides an easy and quick reference to earlier or later statements and facts.

Pacific Conifers

Cone-bearing Trees of the Pacific Coast. By N. A. Bowers. New York. 1942. Whittlesey House. 169 pages. Illustrated. $2.50.

This is a popular field manual designed to aid in the identification of the native conifers of the Pacific Coast. It is one of the Whittlesey House Field Guide Series, its predecessor having been *Trees of the Eastern United States and Canada.* The book provides three keys to identification—by needle, by elevation and by geography. The illustrations aid as well.

Life Science

Experiences in Life Science. By Edna Craig and George K. Stone. New York. 1942. The Macmillan Company. 186 pages. $.88.

This is an excellently planned combination science text and laboratory work book providing practical problems for class exploration and liberally supported by references to the best textbooks in the field for the grade level covered. Certainly use of this book in life science courses in high school should greatly enhance student interest and accomplishment.

Early Minnesota

The Voyageur's Highway. By Grace Lee Nute. St. Paul, Minnesota. Minnesota Historical Society. 115 pages. Illustrated. $.75.

This is the story of the Minnesota lakeland, the North Country, which is rich in history, and the romance of pioneering. The author, who is curator of manuscripts for the Minnesota Historical Society, has delved into the past of exploration, trading and lumbering in this region to produce an interesting and valuable contribution to regional history. Anyone who knows this country will not wish to miss this book.

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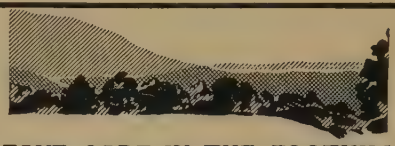

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THE CRISIS IN RUBBER

(Continued from page 240)

admit that only "some" was used, the "some" being the 673,000 ton stockpile, which incidentally, would now be considerably higher if it had not been for the disastrous fire in Fall River last autumn. Much of this natural rubber must be kept in reserve for military purposes to use in conjunction with synthetic when the latter comes into large production in two or three years.

The rubber crisis indicates that our leaders showed very little vision in preparing for the future. Or perhaps it was a lack of teamwork. At any rate the possibility of war with Japan has hung over our heads so long that one might suppose that more adequate supplies would have been gathered and synthetic production started sooner. Certainly not more than "some" foresight was shown.

There are many explanations of this apparent shortsightedness, and it would be a waste of time to examine them all. As a matter of fact the Government began to import for a stockpile in the middle of 1939 and in 1940 imports exceeded by 200,000 tons those of any previous year.

But the difficulty was that measures to save rubber did not begin until June, 1941, were not at all serious until November, and really took hold only after Pearl Harbor. If we had begun to economize on the use of rubber in 1939 our stockpile today would be enormously greater than it is.

One difficulty was the general complacence toward the outcome of a war with Japan. Another possible explanation of our slowness in starting government-aided synthetic plants was the reported desire on the part of our highest government officials to buy rubber from our leading ally, which we were able to do until the Japanese conquests, in order to provide Britain with exchange to help pay for her huge purchases of war supplies in this country.

It is very difficult to apportion blame in these matters. If Mr. Jones, as chairman of the Reconstruction Finance Corporation, had begun to spend half a billion dollars in 1939 or even in 1940 to build plants to make synthetics at double the cost of raw rubber in the world's markets, he would probably have been laughed out of the Government. In the same way it would have been impossible for President Roosevelt to create an army of five or ten million men at that time.

Shortsightedness and lack of vision are not confined to high Government officials. A number of years ago street car tracks were torn up in city after city and buses substituted. How we wish now that we had kept the street cars! Foresight never quite equals hindsight.

For twenty years scientists in the Bureau of Plant Industry of the Department of Agriculture have issued warnings concerning the danger of importing one of our most essential raw materials from the Far East. Dr. O. F. Cook, then principal botanist in charge of the office of cotton, rubber and other tropical plants, wrote as follows on January 29, 1930:

"No other country in the world is so dependent upon rubber as the United States with our use of motor vehicles greatly exceeding all the rest of the world. What it would mean to us to have our supplies of rubber cut off, restricted or even seriously threatened, is something difficult and disagreeable to contemplate, but at least we can see that our deficiency would easily become a means of applying pressure upon us in any contingency of commercial or political tension in the future."

At any rate the message did not get across to the Budget Bureau, to Congress or to the American people. We have all heard wolf cries so often! Last summer Mr. Ickes told us there was a gasoline shortage and it did not then develop. The voices of Dr. Cook and his fellow scientists just did not make themselves heard.

One fundamental difficulty has been the wide range of rubber production costs, ranging at times from five cents for crude to seventy-five cents for certain types of synthetic. In the case of sugar the range is measured in only fractions of a cent a pound, and therefore production of large supplies in our own country seemed to be justified despite high taxes and labor costs.

The products of forest and farm may be just as "strategic" as any mineral or metal. What we did was to use one of Nature's most strategic materials in a way that was cheapest for the moment—but not in the long run. We did not plan for the future and we gave no thought to future national welfare; as a result many millions of motorists will soon be obliged to put up their cars. Apparently the American people, or their leaders, never thought of the word conservation in their use of rubber. Nor did they even think of future profits, only of present ones.

One of the most interesting of Germany's preparations for war was in respect to rubber. As long ago as 1933 and 1934 she began deliberately to make herself independent of imports. This was done not only by expanding synthetic production, as some people seem to think, but by prohibiting the export of scrap, by stimulating the import of scrap, by reducing civilian consumption, and by organizing on a scale far exceeding anything known in this country the collection of scrap.

Germany, of course, was a totalitarian state even then, and could take steps impossible in this country except in war time. But at least we ought now to be able to learn from Germany the supreme importance of planning, of economy in the use of materials, and of the more adequate use of such waste materials as we have. We need to learn how to do these things, not only in war but in peace as well.

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CHIPMUNK NEST

By ROBERT A. SMITH

I had often heard it said that in digging a nest the chipmunk leaves no trace of the nest, no track in the grass, and no loose soil to indicate the entrance or exit. It was said to be able to do this by beginning at the bottom and digging out. Not long ago I took advantage of an opportunity to observe a pair of chipmunks in their nest-making operations.

We had moved into a little cottage facing a country road in Epsom, New Hampshire, and shortly after our arrival a pair of chipmunks—friendly little creatures—seemed to adopt us as patrons and moved into our barn.

The front door of our house was approached by four steps. Around the building was a soil bank level with the top step. As winter approached a wide board was run around on top of the bank about six inches from the house, and the space was filled with dry sawdust. In the spring the boards and sawdust were removed, leaving only a trace of sawdust close to the house. One morning as I walked to the front window I was interested to see the two little chipmunks busily making a careful survey of the bank under the window.

The features that particularly commanded the attention of the little creatures were these: Under the center of the window, and just at the foot of the bank, a sod of perhaps eight inches cubed had been lifted out, leaving a hole. At one side of the window, about eighteen inches from the top of the bank, was a tuft of grass about the size of a dinner plate, and at the other side of the window was a similar tuft about eighteen inches from the bottom of the bank. The chipmunks seemed delighted with the terrain and at once undertook the task of making a nest for themselves.

The place where the sod had been taken out was selected as the place to begin. The bottom of the hole they dug was level with the ground outside. They filled the hole where the sod had been, leaving a pile of soil on top of it.

When the excavation for the nest was large enough they came out of the hole and again went carefully over the bank. Reentering the excavation, they drove a shaft to the center of the upper tuft of grass and made their entrance there. They drove a second shaft to the center of the lower tuft, making that their exit. Then they returned to the place where they had begun and packed the hole full of the soil they had dug out, trampling it down carefully, and putting the surplus soil in the hole from which the sod had been taken. The entrance and exit holes would never be noticed in the tufts of grass, and after a shower the fresh soil where the nest had been dug would not be seen.

When the chipmunks entered the nest they ran up the steps, along the strip of sawdust to a point near the tuft of grass, and jumped into the hole without leaving a mark behind them. In leaving the nest they emerged from the other hole and jumped to the level ground below. So what I had heard was true: nothing was left in sight to indicate the presence of the nest, its entrance or its exit. Such careful observations of Nature's creatures will reveal many interesting things to those patient enough to seek the answers.

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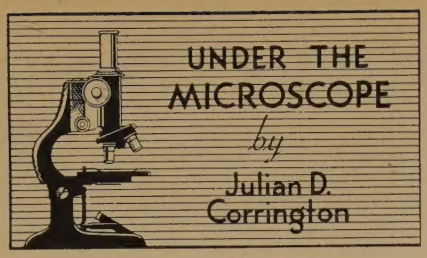


THE MIGHTY MITES

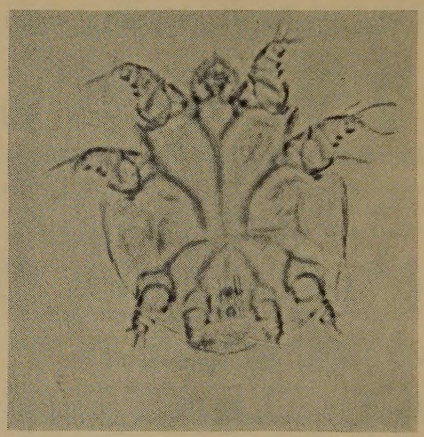
Springtime in one of our eastern states is heralded by the appearance of many objects endeared to poet and Nature lover alike. The crocus of the front lawn and the skunk cabbage of the marsh; the first ringing call of the flicker; the engaging notes of the spring peeper—many indeed are the signs of the season. Constructive signs, let us say. Less publicized and certainly ill suited for romantic usages are the destructive signs—high spring tides and winds, and the annual emergence of billions of man's tiniest and most dangerous foes, the great clan arthropoda. When the sun swings north of the equator, fleas and flies, lice and mites renew the age-old attack on the lord of creation, sowing his blood with devastating infections, slaying more men than all the instruments of modern warfare combined.

They and others of their kind rob him of his livestock and cultivated plants, his forests, his stored foods and clothing, his houses and manufactured products. From April till November the fight is on, a yearly struggle to the finish, with no quarter asked or given. Small size, vast fecundity and numbers, aerial assaults, nocturnal habits, concealed resting stages, biting or piercing and sucking mouthparts, venoms, viruses, pathogenic bacteria and protozoa—these are among the potent weapons of the one side. Man fights back with drugs, serums, vaccines, poisons, sprays, swatting campaigns, traps, and enlists the aid of insect predators as allies. But with all of his intellectual powers he has made scant progress as yet in a war of proposed extermination.

Parasitology has emerged as a major modern science, with techniques of its own, and a breakdown into three main divisions, protozoology, helminthology (worm groups), and medical entomology. We have had one chapter in helminthology with an article on flukes (May, 1940), and this month take up an important section of medical entomology with an introduction to mites. First let's have some remarks on classification.

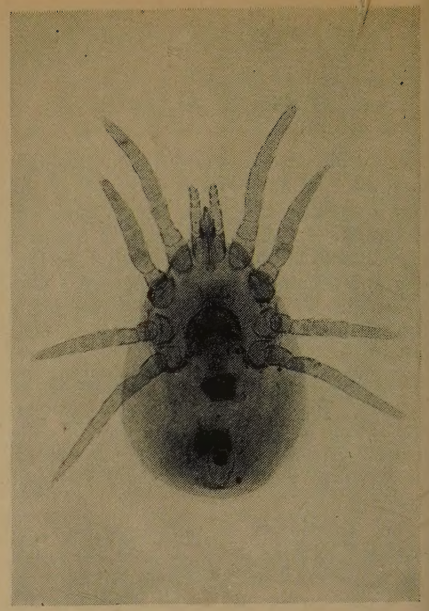
Arthropods are divided into a varying number of classes, since zoologists frequently disagree as to exact relationships of certain minor and aberrant groups. All, however, recognize five major classes, the Crustacea (lobsters, crayfish, shrimps, crabs, water fleas, barnacles), Chilopoda (centipedes), Diplopoda (millipedes), Insecta (insects), and Arachnoidea (spiders, scorpions, mites). This last class is apportioned into five subclasses, of which one, the Arachnida, includes nearly all living forms with which the average person is ever apt to have contact. Here, in turn, are grouped eight orders, the scorpions, spiders, mites, harvestmen (daddy-long-legs), and four minor assemblages.

Arachnids differ from other arthropods in many important respects. They have only simple and never compound eyes; they have no antennae; they have six pairs of appendages, the first being the chelicerae or food-crushing organs, the second the pedipalps, of variable form and function, and then four pairs of walking legs; usually the body is divided into a cephalothorax and abdomen; respiration aerial, by book lungs or tracheae or both. The chelicerae and pedipalps are modified legs and not true jaws. As an insect is known by its six legs, so an arachnid may be recognized by having eight.



For Ear Mite, *Otodectes cynotis*. Slides courtesy Ward's Natural Science Establishment.

Mites comprise the Order Acarina and provide many exceptions to the diagnosis of the subclass. The head, thorax and abdomen are all fused together into an unsegmented body. Generally a small part of the head is secondarily segmented off into a short piece called the capitulum, often mistaken for an entire or true head. It serves as a hinged base for the mouthparts and is best seen in ticks. The chelicerae are usually chelate (pincer-like, as in a crab's claw) in free-living mites, but become cutting lancets in the parasitic species. The pedipalps are leglike and sensory, and the walking legs have hairs or bristles arranged in a characteristic pattern for each species. Some legs end in claws, others in suction pads termed pulvilli. The chitinous integument is wholly membraneous in most, but thickened into protective plates in others. Respiration takes place by tracheae, opening to the surface by a pair of spiracles or stigmata, the position of which forms a basis for one scheme of classification into eight families (orders of some authors). Itch mites have lost their tracheae and obtain oxygen through the skin, or, according to some investigators, through the digestive tract via the mouth.

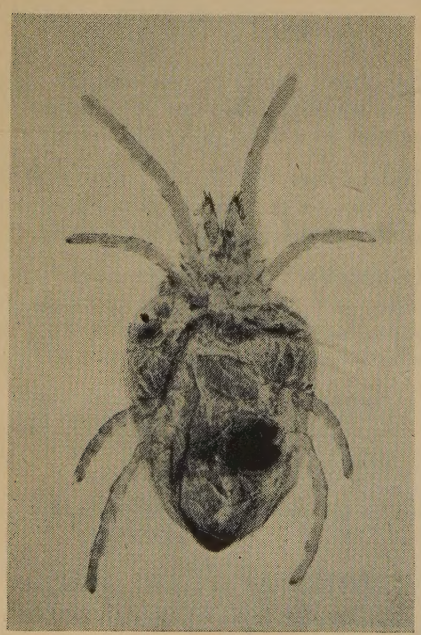


Feather Mite, *Liponyssus bursa*

Most mites are very small, as the name indicates—so small as to be either microscopic or just on the point of visibility without magnification. The ticks, on the other hand, comprising two of the families, attain the relatively huge dimensions of a match head, or even of a pea when engorged. This brings up the question of the difference between a mite and a tick, best answered by stating that ticks are large, blood-sucking, parasitic mites and make up two families out of eight. Thus all ticks are mites but not all mites are ticks. We shall devote a separate article to ticks one of these days.

The Acarina constitute a vast group of worldwide distribution and great economic and medical importance. Their modes of life are highly variable and absorbing in interest to the student of animal ways and behavior. About half the known species are free-living and independent and occur in fresh and salt water and on land, where they are predators on both plants and animals. Others are saprozoic, living on decayed organic matter, as the cheese mite, which does not appear on cheese until this commodity has begun to decay. Still others are parasitic on plants or animals, causing galls or sucking the juices of plants, and dwelling as ectoparasites on many forms of animals, from insects to birds and mammals, including liberal attention to man. Who can say that the widow's mite was solely monetary?

Mites infesting mammals invade the hair follicles or sebaceous glands of the skin, pierce the body covering in order to suck blood, establish their residence on raw skin, under scabs, or excavate burrows and tunnels in the skin. The damage done by the blood-sucking species is usually insignificant in itself, but allows the introduction of many dangerous and even deadly infections, thus accounting for the widespread fear in which certain kinds are justly held. In the case of species living on or in the skin, if allowed to multiply unchecked, the destruction of tissue and irritation to the nervous system



Chigger Mite, *Trombicula irritans*

frequently becomes so profound as to produce death. A few forms are endoparasitic in the air sacs of birds and lungs of mammals.

A favored scheme of classification divides all mites into the following nine families:

ARGASIDAE, the soft ticks, as *Ornithodorus moubata,* dreaded African Hut Tick, vector (carrier) of African relapsing fever. These ticks have no hard plates and emerge at night to feed for a short time on the host's blood, then retire to hideaways, thus not remaining attached to the victim.

IXODIDAE, hard ticks, as *Dermacentor andersoni,* the Rocky Mountain Spotted Fever Tick, transmitting a disease that has now become prevalent in the eastern seaboard states, where it is carried by a dog tick, *Dermacentor variabilis.* Ticks of this family have a hard dorsal scutum or plate covering the whole of the back in males but only a part of the back in females, and attach to the host for days or even weeks. The capitulum projects in front and is visible from above, whereas in argasid ticks it is on the under side and not seen from above.

ERIOPHYIDAE, gall mites, as *Phyllocoptes pyri,* the Pear-leaf Blister Mite. This species has only four legs, is elongate, and appears as if minutely segmented. They stimulate the formation of plant galls, with an external opening through which the mite enters, and within which the eggs are laid, the young mites later escaping through the entrance aperture. Galls made by insects have no such openings.

DEMODECIDAE, elongate and annulate follicle mites, parasitic in the hair follicles and sebaceous glands of man and other mammals. *Demodex folliculorum* attacks man, cattle, and hogs, and produces blackheads.

DERMANYSSIDAE, chicken mites; parasitic species attacking a variety of animals and causing dermatitis in man, as *Dermanyssus gallinae.*

SARCOPTIDAE, itch mites and mange mites, parasitic species living on or in the skin of birds, mammals, and man. *Sarcoptes scabiei* is the human itch mite, burrowing in the skin and there passing through a number of successive generations.

TROMBIDIIDAE, harvest mites. *Trombicula irritans* is the well-known chigger mite or red bug of the United States, the larvae being the pestiferous blood-suckers while adults are free-living. These species have chelate chelicerae, eyes located at the ends of stalks, and the body divided by a constriction into a cephalothorax and abdomen.

TETRANYCHIDAE, red spiders. A common house pest on plants and an agricultural problem on fruit trees, cotton, and other botanical hosts is *Tetranychus telarius.*

HYDRACHNIDAE, water mites. The larva of *Hydrachna geographica* is parasitic on aquatic insects.

Mite life history typically includes egg, larva, nymph, and adult. Most species lay eggs, though a few deposit larvae. Eggs hatch into six-legged or hexapod larvae, lacking a tracheal system and genital aperture. When full grown these molt to become the eight-legged or octopod nymphs, with a tracheal system, but still lacking an external reproductive opening, not acquired until the nymph in turn molts to maturity as an adult. Some are parasitic as larvae only, some as adults only, and others at all stages, in which case two or three different host species are attacked.

Specimens are easily obtained from plants, including the under surfaces of tree leaves, from domestic animals, especially chickens, and from infested mushrooms, decaying cheese, potatoes, meat, sugar, as well as by contacting a veterinarian or hospital laboratory. Mites may be killed in alcohol of 70 to 85% strength, dehydrated, cleared, and mounted in balsam or isobutyl methacrylate. If darkly pigmented they should be bleached in peroxide of hydrogen. Treatment with 10% potassium hydroxide, as in potashing insects, will bleach as well as render the larger species less opaque. Be sure to wash out this caustic thoroughly with several flushes of tap water, adding a few drops of concentrated hydrochloric or acetic acid to the last wash to neutralize any remaining potash. Position the mite carefully before putting on the cover glass. Occasionally a light tinge of such a stain as alum cochineal or fast green may seem desirable; more often mites are mounted unstained.

BEGINNER'S PRIMER

Formerly classed with bugs in the Order Hemiptera, certain families of economic importance have more recently been separated to make up a distinct order, the Homoptera (like-wing), the name referring to the fact that, unlike true bugs, the wings are of the same thickness throughout. As a rule there are four wings, held at rest in a sloping position. The mouthparts are of the piercing-sucking type, but arise from the rear of the underside of the head, whereas in bugs they come from the front portion. The metamorphosis is usually incomplete.

Included among the Homoptera are a diverse series of insects, superficially appearing to differ so markedly as to seem unrelated. There are cicadas, frog-hoppers, tree-hoppers, leaf-hoppers, aphids, scale insects, and others, many of which are among the worst of plant pests. They capture our interest from this standpoint as well as by making among the most attractive and instructive of all insect whole mounts. The first four of these families will merit our attention in the present installment.

Members of the Family Cicadidae, or cicadas, are usually but improperly dubbed "locusts," as in the celebrated seventeen-year "locust." Correctly, a locust is a type of grasshopper, as we have seen in a previous article of this series. These are large, stout insects, familiar to all through their loud and often deafening music, so characteristic of late summer and fall. The seventeen-year species is the Periodical Cicada, *Magicicada septemdecim,* with a remarkably long life for an insect. Females lay their eggs in twigs on trees, the nymphs hatching in about six weeks and dropping to the ground, where they burrow. Feeding on the sap of tree roots, they remain underground until the latter half of May of the seventeenth year following, when they emerge and climb up trees, fence posts and similar supports. The skin then splits down the back and the winged adult comes forth, sings for a while, reproduces, then succumbs to some enemy, as the Cicada-killer Wasp, to disease, or to that old destroying angel of the insect world, Jack Frost.

Seventeen different broods of this species have been mapped in the United States, some of them overlapping in space, and so staggered in time that one or more emerge nearly every year at some locality. Entomologists can predict, from their records, just when any particular district will suffer an

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infestation. In the south there is a thirteen-year race, while other species are annual and adults appear every year.

In November, 1941, we gave an account of the Cicada sound-producing apparatus, and this structure makes a fine slide mount. The illustration that accompanied this account, by the way, was incorrectly titled as "cricket," and those readers who follow this department and save their magazines are asked to make the correction. Cicada wings provide good toto mounts, requiring large rectangular cover glasses or plastic films, while the mouthparts, legs and antennae are also useful.

When afield in the summer you have doubtless seen many of the bubbly masses of white froth on grasses, herbs and other small plants in a meadow, and may know that the countryman has long called this material "frog spit." It was formerly supposed to be the spittle of tree-frogs! The next time you encounter such an object, pry into it with the blade of a pocket knife and you will discover one or more nymphs of a tiny bug-like creature living within this protective enclosure. These molt and grow until mature, when they leave the froth and take up abode on trees and shrubs. They are the Spittle-insects or Frog-hoppers, Family Cercopidae. Under the microscope they are seen to be densely covered with minute hairs; also the leg makes a mount of unusual interest, with its peculiar spines and teeth.

Most bizarre of all insects, the Tree-hoppers, Family Membracidae, consist of tiny little brownies with extremely weird body forms, caused by an elongation of the prothorax, often into one or more long spines. The eyes have an odd and amusingly human look about them, as if they had whites and pupils. Furthermore, the line connecting the eyes and separating the head from the prothorax is prominent and makes these little fellows seem to be wearing spectacles, while the prothorax above appears like some grotesque hat. One species with two huge horns is called the Buffalo Tree-hopper; another has the prothorax shaped like an academic mortar and, with his large, spectacled mien, looks for all the world like a profound scholar of insect philosophy. Still another resembles a celebrant at a New Year's party, while a fourth is a perfect clown.

Tree-hoppers live up to their name, as they hop when disturbed and live among trees and bushes. They do little damage, probably owing to the fact that they are seldom abundant. Not so the next group, the Family Cicadellidae or Leaf-hoppers, many being indeed abundant and some often quite destructive. These too are very small, mostly around one-eighth inch in length, but are flatter and more normal in shape than the tree-hoppers. To make up for this, the best known species are brightly colored, generally green, some trimmed with red and yellow.

If you have ever sat in a screened room quietly reading of a hot summer's evening and been annoyed by small, somewhat triangular, soft-bodied green insects lighting on your book, hands, face or neck, and wondered how they could get into the house—you have made the acquaintance of leaf-hoppers. Touch them and they disappear instantly, seemingly vanishing into thin air; they leap and take wing at the same time—one of the original catapulted airplanes. The characteristic feature is the hind tibia, which is as long as the abdomen and armed with a double row of spines all along its length. This leg makes a handsome whole mount, useful in classification.

Mounts of entire tree-hoppers offer certain difficulties, for though the insects are small enough, the protruding spines may present a problem. Low cells, spun rings, or depression slides will overcome this troublesome projection, and a perfectly clear, water-white mountant, as isobutyl methacrylate, is considerably preferable to balsam. Leaf-hoppers are softer, lack spines, and present no unusual demands for toto mounts. Collecting is most effectively done by sweeping a net through grasses, shrubs and low bushes, resulting in large and assorted captures. Specimens may be killed, fixed, and dehydrated with the usual alcohol series, or processed with any of the newer reagents, including *n*-butyl alcohol, isopropanol, dioxan or cellosolve. These insects are not customarily potashed, though this step may be performed if care is used not to carry it too far. Photographs are best made using very low power (macrographs), and for tree-hoppers should be head-on views of entire individuals.

TRADE NOTES

In certain of the sciences there is a multitude of textbooks, in others a scarcity. Thus a large number of excellent modern general biologies, botanies, or zoologies are available, the difficulty being not that of finding a suitable book but in choosing one from among so many. Embryology, on the other hand, has suffered from too few general works. There have been specialized treatises on particular stages or species, but a real need has existed for years for a clear, comparative, broadly morphological text gotten up in the present vogue, which emphasizes interest, readability, modern illustration and pleasing format. This need has now been met in most admirable fashion by Professor Alfred F. Huettner in his *Fundamentals of Comparative Embryology of Vertebrates.*

So outstanding as to call for primary mention are the illustrations, mostly original and stereographic, and all made by black and white stippling and line drawing technique. They are beautifully done and highly accurate and informational, made from projections and reconstructions of actual specimens. So important did this part of the book seem to the author that he executed the drawings first and then wrote the text around them, a system which certainly has resulted in a book of great beauty, practicability, and readability. The text is condensed, direct, and compelling. Organization of subject matter is also to be commended; the first four chapters take up general preliminaries as to cells, mitosis, gametes and their formation, chromosomes and their rôle in heredity and sex determination; then follow detailed studies of the embryology of amphioxus, frog, chick, and mammal, with emphasis on man. These groups receive appropriate allotment of space, by far the bulk of the book being devoted to frog and chick as the principal laboratory types. Every teacher and student of embryology should inspect this volume. It is far better adapted, also, to amateurs working alone than any other such publication known to us. Pp. xvi, 416; figs. 168. The Macmillan Co., 60 Fifth Ave., New York City, 1941. $4.50.

Students and technicians will welcome a new and comprehensive presentation from an outstanding writer, *Laboratory Diagnosis of Protozoan Diseases,* by Col. Charles F. Craig, famous Tulane authority on tropical medicine. The book is devoted entirely to methods available for diagnoses, and while clinical in approach, will be an important addition to the library of schools and colleges with courses in protozoology or parasitology and of individuals concerned with these specialties, as well as of medical institutions. Inasmuch as diagnosis of protozoan infections rests almost wholly on laboratory methods with references heretofore widely scattered and fragmentary, this new work will fill a decided need.

There are twenty-six chapters comprised in six parts: amebiasis and flagellate infections, leishmaniases, trypanosomiases, coccidiosis, malaria, and balantidiasis. Each part includes in detail all of the methods having any real claim to value in diagnoses, and ends with a critique which stresses the relative merits of the several procedures. A large amount of literature in many languages and from many sources has been examined in the preparation of this work, the author being eminently fitted to sift the entire field. Morphology, collecting, culturing, fixation, staining, serology, and special techniques are discussed at length in each section. The illustrations are helpful, especially the four plates in full color. Pp. 349; plts. 4, figs. 54. Lea & Febiger, 600 Washington Square, Philadelphia, 1942. $4.50.

HORSETAIL SPORES

Have you ever watched the antics of Horsetail spores under the microscope? The Horsetails or Scouring Rushes belong to the genus *Equisetum* and represent the reduced remnants of a once mighty flora that formed great forests of tall plants during the Pennsylvanian, one of the coal-forming geologic ages. They are to be met with today in many waste-place situations, bordering swamps, in sandy patches, and along railroad tracks—places where living conditions are hard and few other plants can gain a foothold.

The stem is hollow and jointed, the leaves represented by small flutings of pointed tips at the joints, and there are two methods by which the fruiting bodies or cones are borne. In most species these cones appear at the tips of the ordinary green stems; in *Equisetum arvense,* however, there are sterile stems, without cones, and separate, earlier, pale stems with cones at the tips.

The cone, or strobilus, consists of closely-packed modified leaves called sporophylls (spore leaves) with a shield-shaped top on the outside and a group of sporangia hanging down internally from this lid. These sporangia are sacs containing the spores, and split open when ripe, permitting escape of the mature spores. A cone may be dissected under a hand lens or lowest power of the compound microscope and to get the spores.

Each spore is a small disc-shaped object to which four club-ended filaments, termed elaters, are attached. These are markedly hygroscopic, denoting that they are very sensitive to changes in moisture, and will twist, turn, kink and coil when moisture is present. Shake a few spores on a microscope slide and add a dry cover glass. While observing through the microscope, add a small drop of water at one edge of the cover. You'll be surprised at the resulting gymnastics! The performance may be repeated as often as desired. Dry spores may be kept indefinitely in a vial, envelope, or veterinary capsule, and demonstrated whenever one wishes to provide the visitor with a bit of entertainment.